FOUNDED BY DR. MAX THOREK

The Journal of the International College of Surgeons

FOUNDED IN GENEVA, SWITZERLAND, 1935 - INCORPORATED IN WASHINGTON, D. C., 1940

Vol. XXVII MARCH, 1957 No. 3

Plastic and Reconstructive Surgery

Immediate Treatment of Traumatic Injuries of the Face

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OF the countless medical accidents confronting mankind today, few present the baffling complexity of the improperly treated severe craniofacial trauma. It is somewhat saddening to observe that while world-wide medical progress is advancing in giant strides and immeasurably improving the lot of humanity, the technologic advances of the past decades have far outstripped human abilities to cope with them. As a result of faster cars and planes, increasingly complex machines and the constant threat of political instabilities dragging us into a disastrous conflict, the emphasis on traumatic surgery is much on the ascendancy. The responsibility for the care of injuries in many instances will rest upon the nearest doctor at hand, regardless of special training. The outcome of the case will often depend on what is done (or, probably more important, what is not done) by the first person to see the case. Anyone who treats craniofacial trauma should be aware of the bizarre psychiatric trauma, let alone the physical complications, that an improperly treated facial injury can bring on. A maimed or crippled person can still assume his place in society; a distorted face, whether on a real or an imaginary basis, presents far greater difficulty in adjust-

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Sept. 21, 1956.

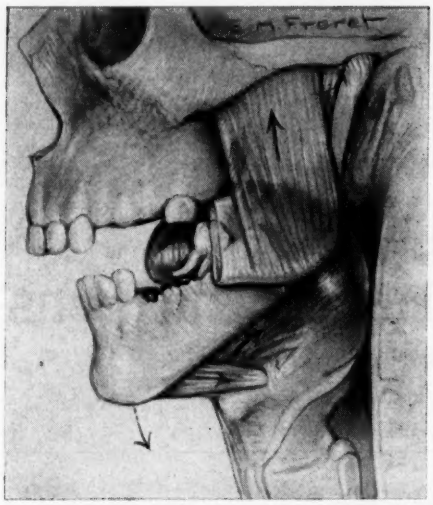

Fig. 1.—Typical distortion after bilateral mandibular fracture. Masseteric spasm pulls proximal fragments upward. Gravity and loss of control of distal fragment cause prolapse of tongue on airway.

ment. In the light of these thoughts no amount of repetition of such an important subject can be excessive.

General Considerations. — Needless to say, coexisting serious conditions, such as shock and injury to vital organs, should receive primary consideration in any case of facial trauma. It is not within the scope of this paper to enter into a detailed discussion of such treatment, which by and large is standard throughout the world.

Brief experience in the handling of such cases should convince anyone that no individual case can be fitted to a textbook illustration or explanation. Do not fit the patient to the book. The surgeon should learn to handle what is available to him and, within the bounds of physiologic response to injury, use his imagination in discharging a dual responsibility; not only to restore cosmetic normality but also proper function.

The *sine qua non* of reconstruction surgical technic is gentle, atraumatic handling of tissues. Every bite with a large toothed instrument is that much more microscopic insult added to the trauma already present. Tissues should be handled with small skin hooks or small plain forceps. The finest pointed hemostats should be used, one should clamp as little tissue as possible and tie off bleeders with as fine a tie as is compatible with the situation. All sponging should be firm but gentle, and rubbing of tissue should be avoided. Gentleness in the handling of contused flaps of skin can spell the difference between a good result and a poor one. Complete hemostasis must be achieved, because hematoma is an unnecessary and dangerous complication. Epinephrine should be used with great care, in recognition of what will happen when its hemostatic effects wear off. It should never be used in the treatment of injuries of the fingers, owing to the danger of losing a digit from vasospasm.

Closure under tension produces poor scars, and undermining of wound edges, if necessary, should be liberal.

Specific Considerations.—The first consideration in a case of craniofacial trauma is the presence of an adequate airway. Very often concomitant fractures of the facial bones, especially the mandible, cause loss of control of the tongue, which falls back on the epiglottis and shuts off the airway (Fig. 1). One should not be panicked into doing an immediate tracheotomy. Simple traction on the retrocessive tongue will often result in dramatic relief. Nevertheless, as a statement of general philosophy, it can be said that if after intelligent evaluation of the situation there is any question in the surgeon's mind as to the need of a tracheotomy, one should by all means perform it, since it is much safer to err on the positive side of this question.

Hemorrhage must be controlled. This

is often more easily said than done, since bleeding often originates in the inaccessible and extremely vascular regions deep in the face. Good light and suction are mandatory; it is useless to clamp blindly, and it is dangerous. Often it will be necessary to control hemorrhage with a pack. If a hemostatic agent, such as gelfoam, is used, it is well to keep in mind the possibility of its becoming dislodged and falling into the larynx.

The extent of the injury must then be thoroughly estimated. The depths of the wound must be establishd by gentle probing, irrigation and visual inspection. Damage to the globe of the eye must be ruled out. The presence or absence of fractures of facial bones must be ascertained. It is worthy of mention that, although roentgenograms of the facial bones are of great help, the emphasis should always be on learning to rely on one's fingers. The bones of the face are largely subcutaneous. It is surprising how quickly and accurately one can evaluate the problem by simultaneous palpation with both hands for comparison. An effective routine is to palpate simultaneously (beginning in the frontal area) the supra-orbital ridges, the orbital margins all around, the nose (shucking for stability), the malar eminences, the zygoma, the body and then the ramus of the mandible. Both the mandible and the maxilla should be shucked for evidence of crepitation or false motion. It should be remembered that edema may cloud the situation, and dental occlusion should also be inspected.

Damage to the facial nerve is to be kept in mind as a probability, and five simple maneuvers will appraise the examiner of the status of the nerve. The patient should be asked to (1) raise his eyebrows; (2) pucker his eyes tightly; (3) wrinkle his

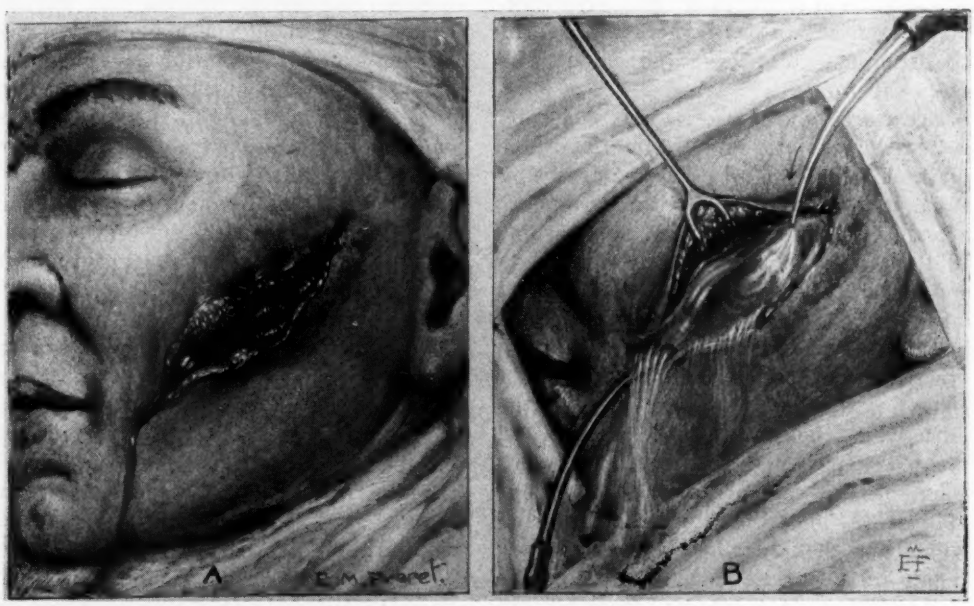

Fig. 2.—*A*, typical contused laceration of cheek down to musculature. *B*, irrigation of wound with copious amounts of saline solution.

nose; (4) bare his teeth and whistle, and (5) tighten his platysma. In this way paresis in any of the divisions of the pes anserinus may be detected.

Rhinorrhea is indicative of a fracture through the ethmoids; otorrhea, of a fracture through the basilar portion of the sphenoid or of the temporal bone. Rhinorrhea is a clear contraindication against any vigorous maneuvering of the patient's face, since an already dangerous situation can easily be converted into a fatal one by inadvertently driving irregular bony projections into the cerebrum, not to speak of increasing the possibility of meningoencephalitis.

The mouth should be thoroughly inspected for broken or loose teeth. These should be extracted to prevent aspiration.

It is easy and sometimes embarrassing to assume, in the course of emergency treatment, that blood in the hair has merely run down from the obvious facial injuries. In this manner severe scalp lacerations, with underlying skull fractures, may be missed. It will, therefore, benefit the examiner to observe and palpate the scalp carefully.

Treatment of Injuries.—It is generally accepted that an acute traumatic injury of the face should, all other factors being equal, be repaired ideally within two hours after the time of injury. One may assume that such an injury by its very nature is contaminated, usually grossly, and that with the passing of the hours the wounds become infected. In these days of antibiotics and chemotherapy the problem is, of course, vastly more simple than in the days when the skill of the surgeon and plain luck played major roles in the outcome of the case. Nevertheless, in our opinion, the most liberal time limit during which one should undertake the primary repair of soft tissue wounds is eight to twelve hours after injury; after this, we should seriously consider packing the wound open, with eventual secondary repair in mind.

The importance of thorough cleansing of wounds cannot be overemphasized, not only from the standpoint of reducing morbidity but with a view to avoiding the completely unnecessary traumatic tattooing of the skin. It is mandatory that all wounds should be thoroughly irrigated with copious amounts of soap and water. Ground-in dirt and débris must be eliminated with a stiff brush, a maneuver more easily executed in a fresh wound than in an old one. All wounds should be carefully probed for débris, particularly glass, which is easy to miss (Fig. 2*B*).

The next step is, of course, closure of the wounds as simply and rapidly, and yet as carefully, as circumstances will allow. Without detracting from the importance of débriding contused and devitalized tissue, one should reemphasize the fact that from the point of view of the reconstructive surgeon only that tissue which is obviously devitalized should be excised. Every effort should be made toward preserving every bit of tissue whose survival is not clearly in doubt, because at the time of secondary revision all this tissue is invaluable in the reconstruction of the part.

The best débridement is obtained through simple excision, with a sharp scalpel, of the contused edges of the wound, care being taken to cut at right angles to the plane of the skin and out to viable, bleeding normal tissue (Fig. 3, *A* and *B*). The best plan for repair is always the simplest plan. Any number of tricky ways to close a wound may be found described in innumerable texts, but it is only sad experience that teaches the surgeon to avoid maneuvers and to depend, if circumstances allow, on a simple, elliptic excision and straight line closure.

If possible, excision should be planned so as to follow Langer's lines. These are the natural lines of tension of the skin,

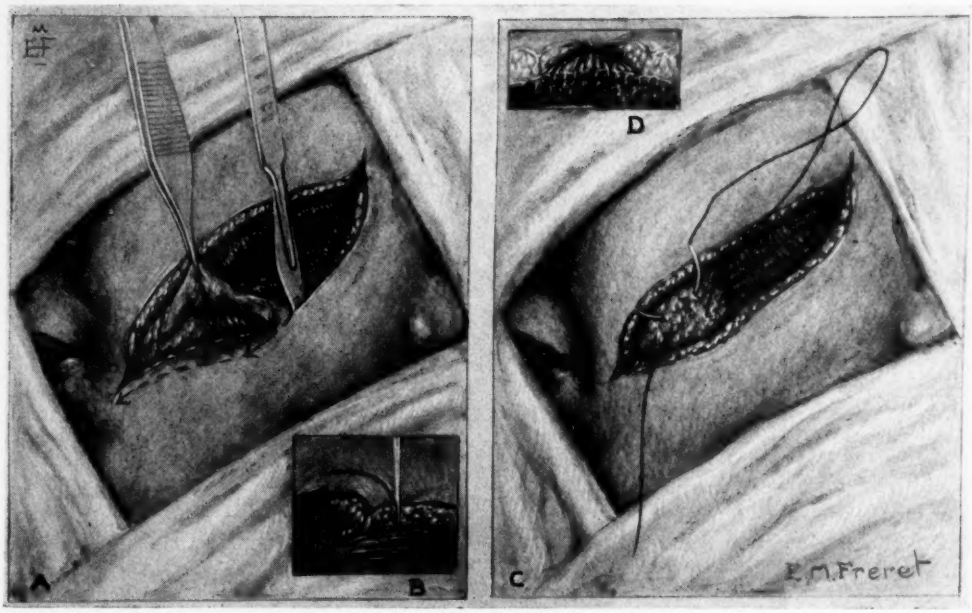

Fig. 3.—*A*, debridement of all devitalized tissue. B, blade at right angle to plane of skin. *C* and *D*, subcutaneous approximation with horizontal mattress sutures in the musculature.

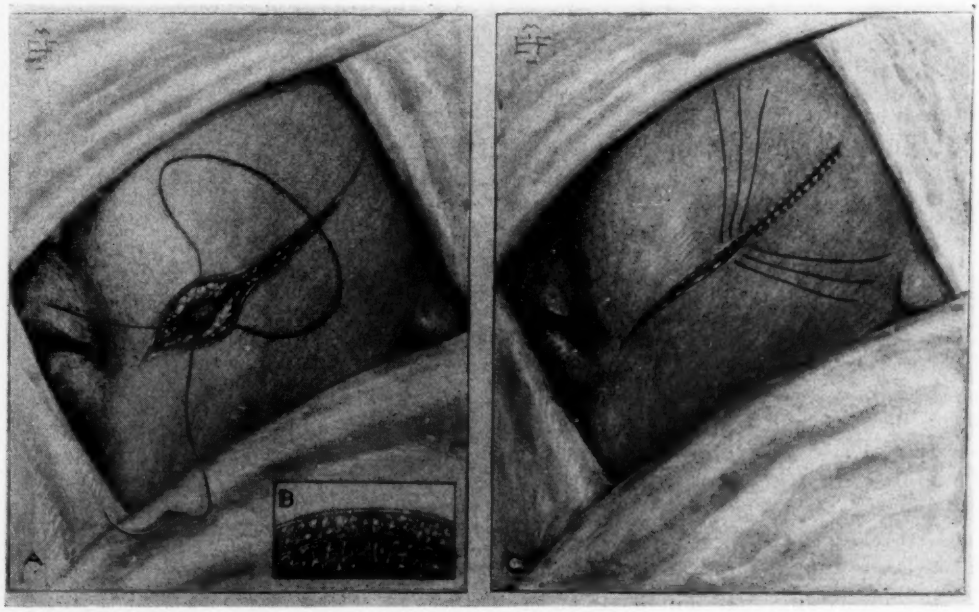

Fig. 4.—*A* and *B*, closure continued in anatomic planes, subcutaneously sutured and buried.

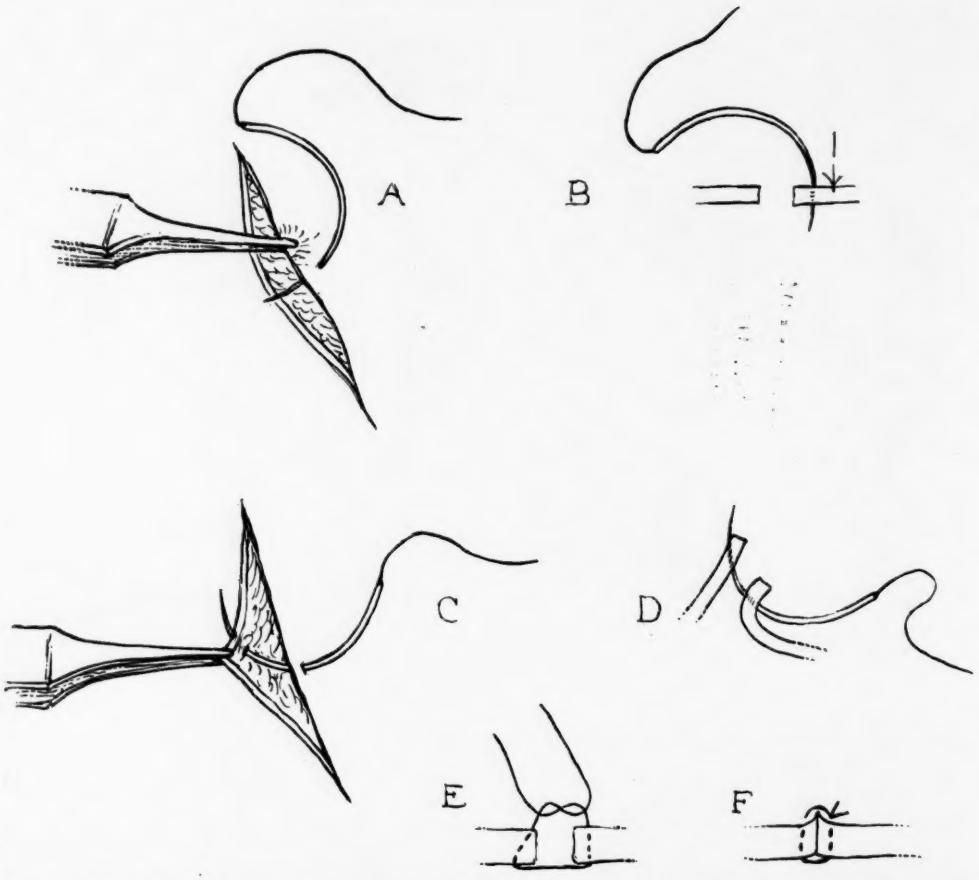

Fig. 5.—*A* and *B*, stitch passed through one side of wound so that point enters and passes through full thickness of skin before it turns under opposite side. *C* and *D*, point of needle enters opposite side of wound, farther out from the margin than its point of exit. *E* and *F*, approximation of tissue, in which slight eversion should occur.

and careful observation of the area involved will readily demonstrate their direction. Asking the patient to create an expression in the area in question will throw the skin into its natural folds, and it is parallel to these lines that excision should be electively planned. This will always make for a much better scar than one that crosses the natural lines and folds of the skin at right angles and is, therefore, subject to increased tension. In some cases exceptions must be made, as with scars that will run across a flexion surface, such as the axilla, the anticubital fossa, the popliteal space or the ventrum of fingers. These scars will cause "fiddle-string" flexion contractures.

If the repair is to be carried out with local anesthesia, we prefer infiltration with 2 per cent xylocaine with epinephrine. We consider this agent ideal in that it possesses excellent diffusibility, low toxicity, adequate duration of effect and, above all, instantaneous action. Although

a regional block provides excellent anesthesia, we have observed that infiltration of the tissues will, in addition, provide the necessary hemostasis.

When epinephrine is used it is well to keep accurate track of the amount of local anesthetic, since an excess will cause obvious and undesirable side effects. Furthermore, excessive use of epinephrine may temporarily stop hemorrhage from large vessels and lull the operating surgeon into a false sense of security, which is rudely shattered when the vasoconstriction effect wears off. Epinephrine is contraindicated in operations on the digits and should be used with extreme caution when there is a traumatized flap with poor circulation, since it may spell the difference between success or failure.

The repair should be carried out then in a logical sequence, beginning in the depths of the wound and closing in anatomic planes (Figs. 3 and 4). The choice of suture material, of course, depends on the surgeon. In our hands white nylon has been satisfactory; it has excellent tensile strength in a 6-0 caliber suture, and tissue reaction is minimal when it is used subcutaneously. Needless to say, the less subcutaneous material compatible with

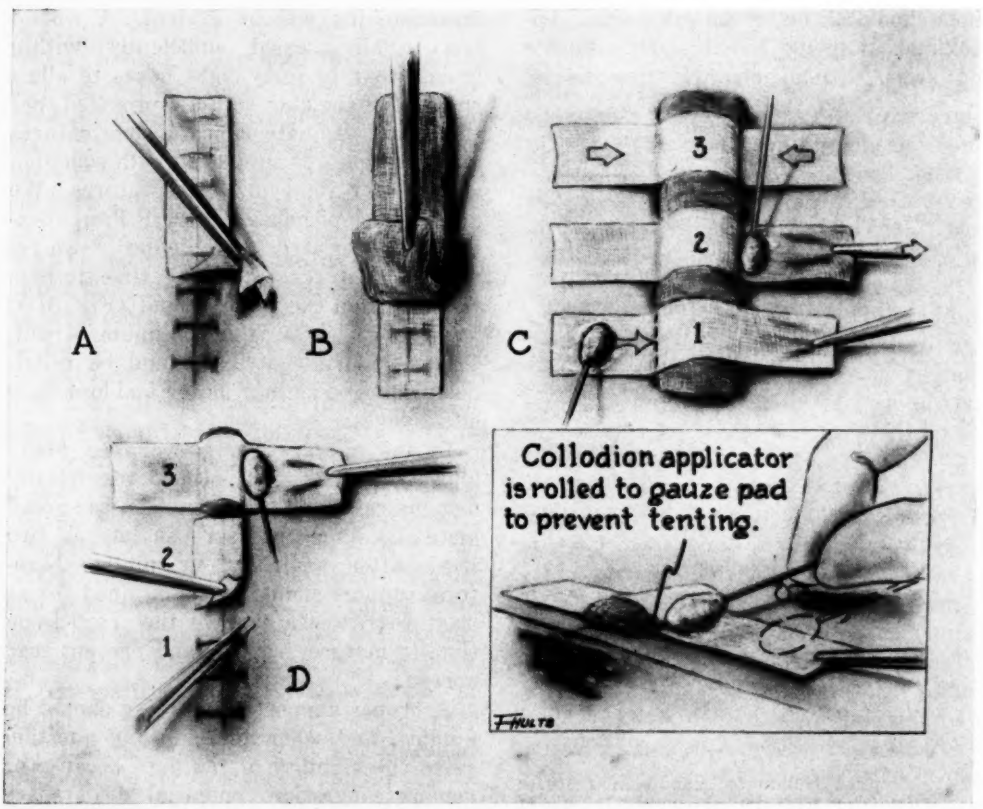

Fig. 6.—Application and removal of sutures and dressing of wound. *A*, application of surgical rayon over sutures to prevent adhesion of dressings. *B*, small piece of gauze for absorption. *C*, application of collodion strips to exert mild pressure. *D*, removal of sutures.

adequate repair, the better.

Any cutaneous incision or laceration can be closed with a few sutures or a great number of them. It is axiomatic that the fewer sutures the more tissue has to be gathered in each stitch, the farther away from the wound the points of entrance and exit of the suture, and of course, the less accurate the approximation. All these factors play a part in the final appearance of the wound. In order to achieve a satisfactory scar, we are convinced that the sutures should be put in no farther apart than 2 mm. and that their points of entrance and exit on either side of the wound should be as far apart from each other as the sutures are from each other. The knots should all be on the same side. Approximation should be extremely accurate and even, without strangulating tissue.

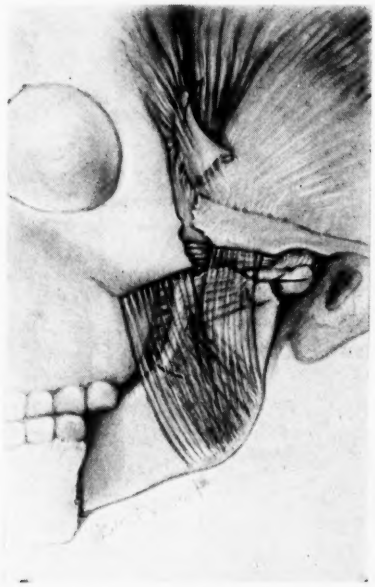

Fig. 7.—Typical comminuted mandibular fracture with coronoid process pulled completely out of relation by temporalis. Condyle pulled down and inward by pterygoids; mandible pulled forward by masseter.

With few exceptions, mattress sutures are unnecessary in closure of the skin, since accurate eversion and approximation can and should be achieved if the needle is passed through the edges of the skin in the proper manner (Fig. 5). Eversion of the skin edges is of the utmost importance, since maturing scars will always contract and pull down. A wound that is evenly approximated may in time become depressed, owing to the scar pull; by the same token, a wound with everted edges will be pulled down even with the level of the skin.

In the ordinary, uncomplicated, "clean" case, the earlier the skin sutures are removed the less inflammatory reaction and crosshatching will be evident. A wound has usually sealed sufficiently within twenty-four to forty-eight hours to allow removal of the skin sutures, provided that there are adequate subcutaneous sutures and the wound is supported with collodion strips after removal of the sutures. We apply strips of gauze with U.S.P. nonflexible collodion across the wound as we remove the sutures, a few at a time, to ease the strain on the fresh wound (Fig. 6*D*). In order to obtain the maximum benefit, these supportive strips should be religiously changed as they loosen and lose their effectiveness.

In the average wound collagen fibers and fibroblasts can be microscopically demonstrated and the wound can be spread apart by finger pressure as late as two weeks after repair. In our opinion, therefore, support should be maintained for at least four weeks to give the scar tissue time to mature properly and prevent scar spread.

A proper supportive dressing should be applied, and when there is any question as to the viability of the flaps because of venous congestion, potential dead space under the wound or dubious hemostasis, a pressure dressing should be applied. If

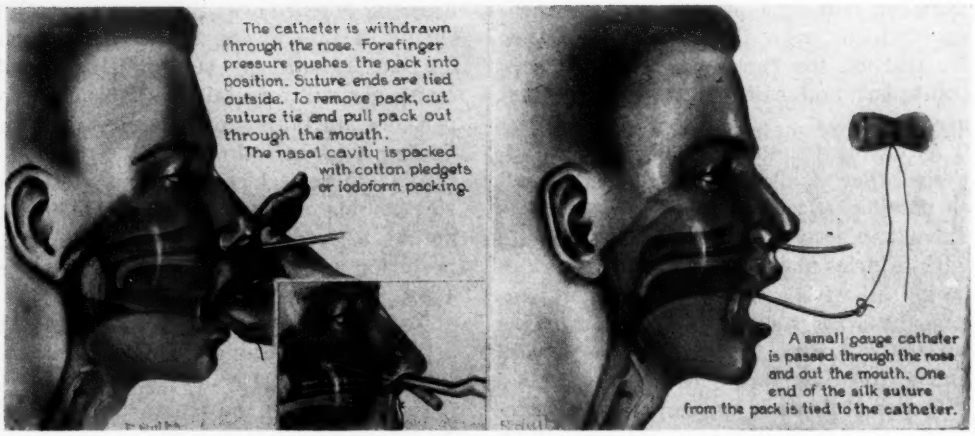
The catheter is withdrawn through the nose. Forefinger pressure pushes the pack into position. Suture ends are tied outside. To remove pack, cut suture tie and pull pack out through the mouth.
The nasal cavity is packed with cotton pledgets or iodoform packing.
A small gauge catheter is passed through the nose and out the mouth. One end of the silk suture from the pack is tied to the catheter.

Fig. 8.—Control of inaccessible nasal or pharyngeal hemorrhages.

elastic bandages are used they should be applied with caution, since they can be treacherous. The patient's complaint of pain or numbness under the dressing should be promptly investigated and not dismissed with an aspirin and advice to "come in tomorrow," because tomorrow may be too late. All uninvestigated wounds producing such complaints may show irreparable damage, with necrosis in a matter of hours. When elastic bandages are applied to extremities they should be wrapped from the digits proximally, and, if possible, the tips of the digits should be left open for inspection.

Special Considerations. — 1. A great many of these injuries are associated with fractures of the facial bones. It is not within the scope of this paper to discuss the treatment of facial fractures, since there are entire texts devoted to this complicated aspect of our work. Nevertheless, a few pertinent observations should be made.

Facial bones are subject to disproportionately powerful stresses and strains by musculature. When a fracture occurs at a crucial point, the muscles often go into spasm and pull fragments of bone entirely out of position, to a degree that will perplex the untrained operator when he encounters a seemingly nonrelated fragment of bone far from the region of injury (Fig. 7). If improperly handled, these vital pieces in the puzzle will cause no end of trouble later. Furthermore, small fragments of bone often have a way of ending in the emergency room bucket. This is a tragic mistake which will give the attending doctor, as well as the patient, cause for regret. All fragments of bone should be replaced and, if still attached to wisps of soft tissue, tacked in place with a suture.

After the presence of an adequate airway has been ascertained and provided there is no rhinorrhea, hemorrhage or other prohibitive factor, an effort should be made to position the fragments in as normal a relation as possible and to immobilize them. Although facial bones, because of their nature, heal in position quickly, and although one is tempted to do a final reduction on the spot, it should be remembered that there are still a few days of grace in which this can be done electively and under the proper circumstances. One should not, therefore, be

panicked into attempting complex maneuvers which, even in expert hands, are frustrating, for these may end in disappointment and can be exceedingly dangerous.

After the fragments have been repositioned, they should be immobilized as well as possible. It is recognized that this is difficult to accomplish when one is dealing with injuries about the face, but much can be gained with a well-placed Barton bandage or with such simple equipment as coat-hanger wire, tape, tongue depressors and a little ingenuity.

External fixation apparatus for maintenance of displaced bony fractures, which is costly, complicated and in most cases impractical, should be shunned. These devices not only work themselves loose before their mission is accomplished but can also produce osteomyelitis, which is otherwise avoidable. There are few facial fractures that cannot be reduced with the judicious use of dental arch bars, rubber bands, Steinmann's pins, stainless steel wire, and, if necessary, a plaster of paris cap with appropriate stiff wire outriggers for traction.

When there is a definite mandibular fracture with loss of control of the tongue, particular care should be taken to maintain a proper airway. An unattended patient can easily strangle on blood clots and salivary secretions. The patient should, therefore, always be placed on the side or the abdomen. Final treatment should be instituted only in a center with personnel and equipment to handle such cases.

2. The blood and lymphatic supply to the head and neck is extremely rich, and collateral circulation is abundant. For this reason it is seldom necessary to leave a drain in the wound. Infection is less likely if the proper principles of surgical care have been observed.

3. If the patient's injury prevents him from closing his eyelids, or if a pressure dressing is to go over the eyes, the eyelids should be sutured together with a simple, horizontal mattress stitch. This simple maneuver will forestall the unpleasant experience of taking off the dressing and finding a corneal abrasion.

4. If there is bleeding from the posterior portion of the nasal cavity which cannot be located and controlled directly, a posterior pack will have to be inserted (Fig. 8).

5. If there is any question as to the aspiration of missing teeth, a roentgenogram of the chest should be taken.

6. All teeth in the fracture line should be extracted.

7. Through-and-through lacerations of the tongue, even of a tongue hanging on a small pedicle, should be sutured. The tongue has an excellent blood supply and amazing powers of survival.

8. If occlusive dressings are employed, beware of their effect on the severance of nerve supply. Furthermore, the axis of blood flow is forced in a principal direction, and as a result the arterial pressure will usually be greater than the venous, thus predisposing to the congestion. This accounts for the blueness of most traumatically elevated flaps of tissue. Pressure and careful periodic inspection will often be a great help. Dead whiteness, on the other hand, means arterial insufficiency, and the survival of such tissue is much in doubt.

10. Tetanus antitoxin and heavy doses of antibiotics are clearly indicated in the supportive therapy. If there have been facial fractures, a high caloric, high protein diet, supplementary intravenous feedings and parenteral vitamins should be ordered.

SUMMARY

The authors discuss the immediate emergency treatment of injuries to the

face, emphasizing the absolute necessity of gentle handling throughout, and the fact that the prime consideration in dealing with a craniofacial injury is to make sure of an adequate airway. Hemorrhage must also be strictly controlled, and the extent of the injury investigated. The possibility of damage to the facial nerve must be investigated. The status of the teeth is most important.

In treatment, thorough cleansing of the wound is of the first importance. When tissue must be excised, the excision should be planned to follow Langer's lines (the natural lines) of tension on the skin. The author's technic is described and illustrated.

RESUMEN

Los autores discuten el tratamiento inmediato de emergencia de las lesiones de la cara, enfatizando el constante manejo fino y el hecho de que la primera consideración al tratar con una lesión cráneo facial es asegurar adecuadamente las vías aéreas. La hemorragia debe ser estrictamente controlada y la extensión de la lesión investigada. También debe investigarse la posibilidad de daño al nervio facial. El estado de los dientes es de suma importancia.

En el tratamiento, la limpieza meticulosa de la herida es de primordial importancia. Cuando haya que remover tejido, la excisión debe planearse siguiendo las líneas de Lange (las líneas naturales de tensión de la piel). Se describe e ilustra la técnica del autor.

RÉSUMÉ

L'auteur discute le traitement d'urgence immédiat des blessures de la face, soulignant la nécessité absolue d'une conduite délicate durant tout le traitement. Il est essentiel que les lésions soient accessibles à l'air. L'hémorragie doit être strictement contrôlée, ainsi que l'extension des lésions. La possibilité d'une atteinte du nerf facial doit être envisagée. Le status dentaire est aussi des plus importants.

Lors du traitement, un nettoyage complet de la plaie est indispensable. Lorsque des tissus doivent être excisés, l'excision devrait se faire en suivant les lignes de Langer (lignes naturelles de la tension de la peau). La technique de l'auteur est décrite et illustrée.

RIASSUNTO

L'autore tratta la cura d'urgenza delle lesioni della faccia, sottolineando l'assoluta necessità di manovre delicate e l'importanza di assicurare la pervietà delle vie aeree prima di ogni altra cosa. Anche le emorragie devono essere controllate con cura. Si deve esplorare la lesione completamente, ricercare un eventuale interessamento del nervo facciale ed esaminare lo stato dei denti.

Un'accurata detersione della ferita è assai importante; quando è necessario sacrificare dei lembi di tessuto bisogna orientare la escissione secondo le linee di Langer che sono le linee naturali di tensione della cute.

Viene descritta ed illustrata la tecnica personale.

ZUSAMMENFASSUNG

Die sofortige Notbehandlung von Gesichtsverletzungen wird erörtert unter Hervorhebung der unbedingten Notwendigkeit eines durchwegs behutsamen Vorgehens sowie der Tatsache, dass bei Verletzungen des Gesichtsschädels in erster Linie die Sicherung freier Luftwege berücksichtigt werden muss. Von Wichtigkeit sind ferner sorgfältige Blutstillung,

Erforschung des Umfangs der Verletzung, Erkennung etwaiger Schädigung des Gesichtsnerven und Untersuchung der Zähne.

Bei der Behandlung ist in erster Linie eine sorgfältige Reinigung der Wunde erforderlich. Die Resektion von Gewebe, das entfernt werden muss, soll unter Berücksichtigung der Langerschen Linien (der natürlichen Linien der Hautspannung) erfolgen. Die Technik des Verfassers wird an Hand von Illustrationen beschrieben.

. . . It is the destiny of mankind that at all times many individuals must suffer and die from disease. A greater perfection of medicine would not be in harmony with this course of events. It is, in part, the calling of the physician so to render assistance that, through the trust placed in him and by his personal and professional influence the most trying situations, the greatest dangers and death itself will be borne with greater fortitude and resignation.

—*Stieglitz*

Before the days of anaesthetics, a patient preparing for an operation was like a condemned criminal preparing for execution. He counted the days till the appointed day came. He listened for the echo on the street of the surgeon's carriage. He watched for his pull at the door-bell; for his foot on the stair, for his step in the room; for the production of his dreaded instuments; for his few grave words, and his last preparations before beginning. And then he surrendered his liberty, and revolting at the necessity, submitted to be held or bound, and helplessly gave himself up to the cruel knife . . .

The *unconsciousness* of the patient secured by anaesthetics is scarcely less important than the *painlessness* with which they permit injuries to be inflicted on him, To steep his senses in forgetfulness, and throw the whole intellectual machine out of action, when if allowed to work, it only moves with a rapidity and irregularity which threatens its integrity, and permanently injure it, is to do him a service, second only to that of saving him from suffering. And to make it impossible for him to recall a scene of horror, and torture himself by going over and over all its incidents again and again, is also to do him a signal service.

—*Simpson*

Refrigerated Skin Grafts

A Bacteriologic Study

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IN the majority of patients with injuries requiring skin grafts, there is an immediate availability of skin from the patient himself (autogenous grafts). This precludes the necessity of a skin bank in most instances. For patients requiring coverage with homografts, however, it is extremely useful to know how long samples of skin may be used with a reasonable expectancy of survival. Considerable work has been and is being done by many institutions on methods of storage. This work is of prime importance with regard to mass casualties and to the extensively injured person who requires cutaneous resurfacing over vast areas.

It is our purpose here to present our observations in a bacteriologic study of skin preserved in the simplest manner, i. e., in an ordinary refrigerator.

In the rotation of stored skin grafts, it was noted that some samples that were being discarded because of age, but with the original seal intact, had an offensive odor. This did not appear to be due to necrosis, and on bacteriologic examination (culture) the samples proved to be grossly contaminated. This observation was the stimulus for routine culturing of skin grafts. These cultures were taken in both "surgically clean cases" and "surgically dirty cases," and a culture follow-up was done on all samples.

Method of Study.—During a two-year period, without special selection, cases in which skin grafting was required were utilized in this study. In both surgically clean and surgically dirty cases, samples of skin were taken in the operating room at the time of the definitive surgical procedure. The donor areas were routinely washed with soap and water then cleaned with ether alcohol (70 per cent) and phemerol. Skin grafts were taken with a Padgett Hood dermatome, and two samples of skin were immediately cut off. One was placed in a sterile petri dish for culture; the other was wrapped in a saline-moistened sponge, placed in a glass tube plugged with cotton or a cork and sealed with liquid paraffin. The tubes were labeled with the patient's name and the date and were stored in an ordinary refrigerator (3 to 5 C.). Twice, at three-week intervals (three weeks and six weeks), these samples were opened under sterile precautions and specimens were again taken for culture. In some cases nine-week cultures were made, but these yielded no information other than that tabulated for the three-week and six-week periods.

The samples used for culture were routinely minced with sterile saline solution, and the residue was then used to inoculate a tube of thioglycolate broth and a chocolate agar plate. Bacteriologic iden-

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Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Oct. 1, 1956.

TABLE 1.—*Bacterial Growth in One Hundred Skin Sample Cultures*

"Clean" Surgical Cases—38 (38%) (Good "Take" in All Grafts)			"Dirty" Surgical Cases—62 (62%) (Good "Take" in All but Three Grafts)		
	Growth			Growth	
Initially	*After 3 Weeks*	*After 6 Weeks*	*Initially*	*After 3 Weeks*	*After 6 Weeks*
18 (47.4%)	8 (21%)	2 (5.3%)	34 (54.8%)	10 (16.1%)	1 (3%)
	No Growth			No Growth	
Initially	*After 3 Weeks*	*After 6 Weeks*	*Initially*	*After 3 Weeks*	*After 6 Weeks*
20 (52.6%)	12 (31.6%)	10 (26.3%)	28 (45.1%)	18 (29%)	16 (25.8%)

tification and colony counts were made by the department bacteriologist. The cultures were incubated and observed at twenty-four, forty-eight and seventy-two hours.

Bacteriologic Results. — One hundred samples of skin were cultured (Table 1). Thirty-eight were from surgically clean cases. In most instances these required only one or two drums of skin for grafting and had minimal open wounds or none. In all of these the grafts were taken at considerable distance from the operative area. Sixty-two samples were from surgically dirty cases, the majority of these being from burned patients. In some of the latter (six per cent) the grafts were necessarily taken from areas adjacent to the open wounds.

On initial culture, eighteen (36.8 per cent) of the clean and thirty-four (54.8 per cent) of the dirty cases were positive. In the clean cases, this again emphasizes the fact that the skin is difficult to sterilize. When grafts of varying thickness are taken and the dermal appendages cut across, one can expect a certain number of the grafts to be laden with bacteria. It is clinically significant that complete "takes" were obtained in all of the surgically clean cases. Bacterial contamination, therefore, is not necessarily the only cause of loss of some grafts. In the surgically dirty cases (54.8 per cent positive) most of the grafts were taken at a distance from the open wound (6 per cent from an adjacent area), yet the percentage of initially positive samples was much greater than this. One might expect initial contamination of grafts taken from areas adjacent to open, granulating wounds, and this was noted to be true in all of these cases. Again, the "takes" of the grafts were good (95 per cent or better) in all cases except 3. In 2 of the 3 the "take" was estimated at 70 to 80 per cent; in the third, re-grafting of approximately 50 per cent of the area was required. In all three the colony count per plate was initially high (200 to 300), with nonhemolytic Staphylococcus and proteus organisms in abundance. It is interesting that a high staphylococcic count alone was present in 15 other cases, in which good "takes" were obtained. Postoperative care, however, was increased a great deal in these 15 cases. Recent work on the bacteriology of burns is interesting in that aspirations from the spleen have revealed bacterial contamination in cases of extensive surface burns. It has been proposed that the rapid deterioration and febrile course of patients so burned is due to a massive bacteremia, even though blood cultures of the same cases are usually negative. We suggest that a pooling of bacteria in the spleen as observed by Price[1] possibly exists in relation to the skin as well. The increase in initially positive skin samples in dirty cases when grafts were taken at a distance, is not considered explainable on the basis of surface contamination alone. In

10 of the 34 initially positive dirty cases negative cultures were obtained by swabbing the surface of the skin after preparation for taking the graft. A minced skin culture might be of more value than a blood culture in evaluation of the burned patient's condition.

Samples of skin not positive initially were cultured again in three weeks and in six weeks. In 40 per cent of the initially negative clean cases the cultures were positive in three weeks; in 16.6 per cent, in six weeks. In the dirty cases, 35.7 per cent of the initially negative cultures were positive in three weeks and 11.1 per cent in six weeks. It is possible that part of the increase was due to personal handling and air contamination. Other samples may have contained bacteria originally but not on the segment cultured. These categories are not considered valid enough for analysis.

The types of bacteria cultured had no relation to the "take" of the grafts, except in the 3 cases aforementioned. The types cultured were the usual contaminants of skin, nonhemolytic Staphylococcus aureus being by far the most common (Table 2). It is of interest that most of the patients with open wounds were being given antibiotics, with little if any effect on bacterial growth in the skin; at least, no association could be made in our analysis. It appears that skin should be used when taken or, if stored in an ordinary refrigerator, as soon as possible, because nearly 50 per cent of grafts even in clean cases are contaminated from the beginning. Since 68.4 per cent of the grafts in clean cases and 70.9 per cent of those in dirty cases are contaminated by bacteria in three weeks, this is probably a useful limit of time for refrigeration of grafts by this method.

TABLE 2.—*Positive Cultures*

No. of Cases	*Type of Colony*	*Colonies/Plate*
46	Staphylococcus nonhemolytic	1—300
18	Gram-negative rods	1—20
14	Beta streptococcus	2—3
5	Bacillus subtillis	1—3
4	Staphylococcus hemolyticus	1
3	Bacillus proteus	*Plate Covered*
3	Diphtheroids	1
2	Alpha streptococcus	3
2	Aerobacter aerogenes	1
2	Neisseria	1
1	Gram-positive rods	3

SUMMARY AND CONCLUSIONS

One hundred samples of skin have been cultured. Thirty-eight were from "surgically clean cases" and 62 from "surgically dirty cases." Eighteen (36.8 per cent) of the samples from the former group and 34 (54.8 per cent) from the latter reacted positively on initial culture. The "take" of the skin grafts was good (95 per cent or better) in all but 3 cases and these were "dirty" cases in which proteus organisms were combined with nonhemolytic Staphylococcus aureus. As noted in the "clean cases," the skin is difficult if not impossible to sterilize by routine surgical preparation, but bacterial contamination by itself is not the usual cause of graft failure. In the "dirty" cases an increase in the number of initially positive cultures was out of proportion to the number of these cases (6 per cent) in which the grafts were taken from areas adjacent to open wounds. In 10 instances in which negative cultures resulted from swabbing the skin, samples of skin still yielded positive cultures. It is suggested that there is a pooling of bacteria in the skin similar to that observed by Price in the spleen, even when cultures of the blood are negative. Cultures of the skin may be beneficial in evaluating the bacteremia of the extensively burned patient.

The types of bacteria cultured are tabulated.

When ordinary refrigeration is used for the storage of skin in saline sponges, practical use probably should not be attempted after three weeks. Fresh grafts should be used instead, since there is a high incidence of bacterial contamination in "clean" as well as in "dirty" surgical cases.

RIASSUNTO E CONCLUSIONI

Furono allestite culture con 100 campioni di cute, di cui 38 da interventi non settici e 62 da interventi settici. Il 36,8% dei campioni del primo gruppo e il 53,8% di quelli del secondo gruppo furono positivi. La presa dei trapianti cutanei fu buona (95% o anche meglio) in tutti i casi, tranne che in 3 in cui era presente il proteo assieme allo staf. aureo non emolitico.

Si è dimostrato che anche nei casi "puliti" la cute è molto difficile da sterilizzare, ma la contaminazione batterica non è la sola causa di insuccesso dei trapianti. Nei casi "sporchi" la positività delle culture non era proporzionata al numero dei casi in cui la cute fu presa in vicinanza di ferite. Si suppone che vi sia nella cute una presenza di germi simile a quella osservata da Price nella milza anche quando le emoculture sono negative. Le culture di cute possono essere utili per valutare la batteriemia nei grandi ustionati.

Quando si usa la refrigerazione per la conservazione della cute, il suo impiego non deve essere ritardato oltre le tre settimane. Si dovrebbero usare trapianti freschi, a causa della grande facilità all'inquinamento di essi.

RÉSUMÉ ET CONCLUSIONS

L'auteur a procédé à la culture de 100 prélèvements de peau; 38 provenaient de "cas chirurgicaux aseptiques," 62 de "cas chirurgicaux septiques." 18 (36,8%) des premiers prélèvements et 34 (54,8%) des seconds étaient positifs initialement. La "prise" des greffes épidermiques a été bonne (95% et plus) sauf dans 3 cas contenant des protéobacilles avec du staphylocoque non hémolytique.

Comme cela a été constaté dans les "cas aseptiques," la peau ets difficile sinon impossible à stériliser par une préparation chirurgicale de routine, mais la contamination bactérienne seule n'est pas la cause habituelle de l'insuccès des greffes. Dans les "cas septiques," l'augmentation de la pullulation bactérienne des cultures initialement positives a été hors de proportion avec le nombre des cas (16%) dans lesquels les greffons furent prélevés dans le voisinage de plaies ouvertes. Dans 10 cas de cultures devenues négatives à la suite de tamponnements, les prélèvements épidermiques montraient encore des cultures positives. L'auteur pense qu'il se passe peut-être avec les bactéries de l'épiderme un fait similaire â celui observé par Price dans la rate, même lorsque les cultures du sang sont négatives. Les cultures épidermiques peuvent être utiles pour évaluer la bactérémie des grands brûlés. L'auteur montre un tableau des divers types de bactéries.

Les fragments congelés (éponges salines) ne devraient pas être utilisés après un délai de trois semaines. Il faudrait donner la préférence à des greffons frais du fait de l'incidence élevée de la contamination bactérienne dans les "cas chirurgicaux aseptiques" aussi bien que dans les cas "septiques."

SUMARIO E CONCLUSOES

Foram cultivadas cem amostras de pele. Trinta e oito foram obtidas de "casos cirurgicos não contaminados" e 62 de "operados infectados." Dezoito (36.8%) das amostras de casos não infectados e 34

(54.8%) dos casos infectados foram positivas, inicialmente. A integração dos enxertos de pele foi boa em todos os casos exceto em 3 (95% ou mais) em que o proteus se associava com estafilococo aureo não-hemolítico. Como foi verificado nos casos limpos é dificil senão impossivel esterelizar a pele pelos métodos de rotina porem a contaminação não é o único fator na perda do enxêrto. Nos casos contaminados o aumento inicial das culturas positivas não foi proporcional aos daqueles (6%) em que os enxertos foram obtidos de pele vizinha a lesões. En 10 ocasiões em que surgiram culturas negativas depois de tratamento da pele ainda assim as amostras de pele puderam mostrar culturas positivas.

Pensa-se que que há uma mistura de bacterias na pele da mesma forma como foi observado por Price no baço, mesmo quando as hemoculturas se mostraram negativas. As culturas de pele podem auxiliar a avaliação da bacteriemia dos pacientes gravemente queimados. Os tipos de germes são apresentados.

Quando se uza a refrigeração ordinaria para banco de pele em solução salina a utilização não devia ser tentada apos três semanas. Os enxêrtos frescos podiam ser uzados porque havia uma incidência elevada de contaminação bacteriana tantos nos casos limpos como nos contaminados.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Es wird über die Anlegung von Bakterienkulturen von hundert Hautpräparaten berichtet. 38 Hautstücke stammten von "chirurgisch reinen" und 62 von "chirurgisch unreinen" Fällen. Achtzehn (36,8%) der Präparate von "reinen" Fällen und 34 (54,8%) der Präparate von "unreinen" Fällen waren anfänglich positiv. Das Einheilen der Hauttransplantate war gut (95% oder mehr) in allen Fällen bis auf drei, und diese stammten von "unreinen" Fällen, in denen Proteusbazillen mit nicht hämolytischem Staphylokokkus aureus kombiniert waren. Wie sich bei den "reinen" Fällen herausstellte, ist es schwer wenn nicht unmöglich, die Haut durch routinemässige chirurgische Vorbereitung zu sterilisieren; die bakterielle Verunreinigung allein ist jedoch nicht die gewöhnliche Ursache für ein Versagen der Einheilung des Transplantats. In den "unreinen" Fällen stand der Anstieg der anfänglich positiven Kulturen in keinem Verhältnis zur Anzahl dieser Fälle (6%), in denen die Transplantate aus der Nachbarschaft offener Wunden genommen wurden. In zehn Fällen, wo nach Abtupfen negative Kulturen beobachtet wurden, zeigten die Hautpräparate noch immer positive Kulturen. Es wird angenommen, dass in der Haut eine Vermischung der Bakterien erfolgt, ähnlich wie Price es in der Milz beobachtet hat, selbst wenn die Blutkulturen negativ sind. Hautkulturen können zur Auswertung der Bakteriämie bei Kranken mit ausgedehnten Verbrennungen von Nutzen sein. Die Arten der kultivierten Bakterien werden tabellarisch angeführt.

Wenn zur Aufbewahrung der Haut in Kochsalzlösung enthaltenden Schwämmen gewöhnliche Kühlung verwendet wird, so sollte eine praktische Benützung des Materials nach drei Wochen nicht mehr versucht werden. Man soll frische Transplantate benützen, weil das Vorkommen bakterieller Verunreinigung sowohl in den "reinen" chirurgischen Fällen als auch in den "unreinen" häufig ist.

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Total Reconstruction of the Ear

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A CHILD born with a deformity of the external ear and absence of the ear canal and eardrum presents a problem for the family doctor or pediatrician as well as for the otologist and the plastic surgeon. The child's parents are concerned regarding deafness and the otologist is eventually called upon for an opinion regarding the hearing.

Roentgenograms are usually taken of the child's temporal bone, and these indicate that the internal ear is probably present, with evidence of a middle ear cavity and the suggestion of a bony outline in the area of the external auditory canal. Not infrequently, however, the latter may be absent, because an accurate determination with regard to the presence of an external auditory canal is somewhat vague at this early age. Some otologists advise the parents that a drum membrane may be present and that later an opening may be made in the region of the ear canal to improve the child's hearing. Others, unhappily, operate on the infant in an attempt to expose the drum membrane. This is almost always a useless procedure; moreover, it results in scar tissue formation and occasionally facial paralysis.

In such cases it is not actually difficult to make a reasonably accurate estimation of the child's hearing and the general management of the case. Our own experience with a large series of patients with deformity of the external ear and congenital meatal atresia indicates that the hearing and the deformity fit into a rather general pattern, permitting a routine of management that may be presented to the child's parents.

The Child's Hearing.—The internal ear develops separately from the middle and external ear, which develop together, and it also develops earlier. Congenital anomalies of the external ear are often associated, therefore, with deformities of the middle ear. The internal ear, however, is usually normal, so that children with absence or deformity of the auricle associated with meatal atresia usually have normal bone conduction on the side of the deformity. The psychogalvanometer may be used to demonstrate the presence of hearing on the involved side at an early age, and we utilize this test occasionally to relieve the parents' worries. Often this is not necessary, however, and assurance that the child in all probability has hearing on the involved side will persuade the parents to cease worrying and wait until the child is old enough for an accurate audiometric test of the hearing.

Infants with bilateral meatal atresia present a more difficult problem. There is always a diminution in hearing, which may be sufficiently severe to delay the time when the child begins to speak. The internal ear is usually relatively normal. The formation of a skin-lined opening into the antrum will improve the hearing and facilitate earlier speech. In gen-

From St. Barnabas' Rehabilitation Center, Newark.
Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Sept. 21, 1956.

eral, however, we have been inclined to advise hearing aids for children with bilateral meatal atresia at a very early age, the exact time depending on the cooperation of the child and the ability of our audiologist to induce acceptance of a hearing aid. In many instances this can be successfully accomplished, so that the child with a relatively normal auditory nerve may learn to speak satisfactorily. If the hearing aid is not satisfactory, a skin-lined opening into the antrum or middle ear cavity may be provided. In our series fenestration has not been necessary.

A normal drum membrane is never present in a patient with typical or complete meatal atresia. Operations to provide a skin-lined opening in the canal region in

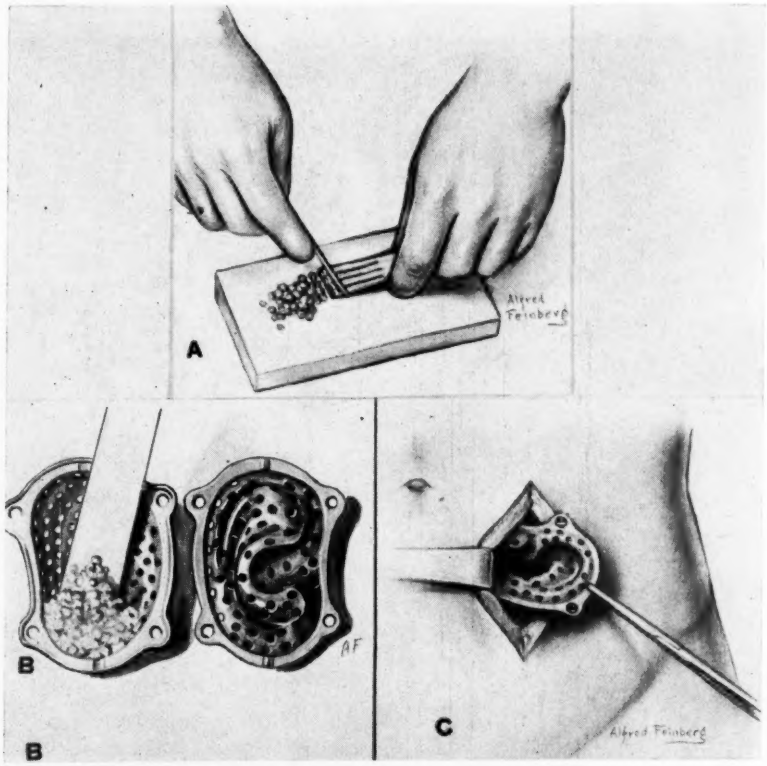

Fig. 1.—Formation of ear framework from diced cartilage grafts inserted in vitallium ear mold. *A*, rib cartilage removed from right side of patient's chest, diced into many small cartilage shavings. *B*, "diced cartilage grafts" introduced into each half of a perforated vitallium ear mold. *C*, halves of ear mold fastened together with vitallium screws, pressing the diced cartilage grafts into the shape of an ear. Mold containing segments of cartilage is inserted in pocket beneath the patient's abdominal skin. During a period of months, blood vessels and connective tissue grow through openings in mold and fasten separate segments firmly, simulating ear. When both auricles are being reconstructed in a young child, diced cadaver cartilage is used to supplement the child's own cartilage, so that there will be sufficient cartilage to fill both right and left ear molds. The operative procedures for the two ears are carried out simultaneously. Thus, the total number of operations for reconstructing two auricles is the same as for reconstructing a single auricle. The vitallium ear molds are made by the Austenal Company of New York City. Medium and large models are available to meet the general requirements of individual cases. *Reproduced by courtesy of* **Plastic and Reconstructive Surgery** (**3**:*653, November 1948*).

the hope of exposing a drum membrane are, therefore, useless. In rare instances (2 in our experience) a fibrous membrane may be present in a relatively normal external ear canal. Removal of this fibrous membrane, which often has a small opening in the center, may expose the inner portion of the ear canal and a drum membrane. This, however, is extremely rare and can be readily differentiated from typical meatal atresia by the presence of a normal external portion of the bony canal with a thin membrane-like structure occluding the lumen.

Children with congenital meatal atresia on one side and a normal canal and drum membrane in the opposite ear will usually hear well and learn to speak at the usual age without difficulty. When only one ear is affected, therefore, the parents may be

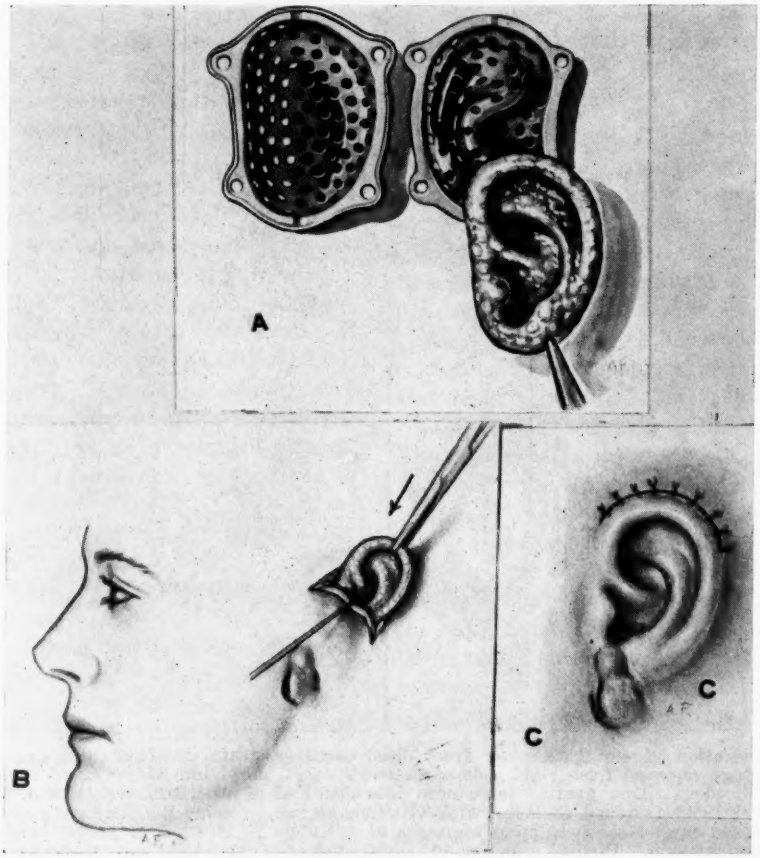

Fig. 2.—Removal of diced cartilage ear from mold and transplantation in aural region. *A*, the vitallium ear mold removed from the abdominal pocket five months after burial. Halves of mold have been separated and diced cartilage ear framework removed. *B*, diced cartilage ear framework inserted in a previously delayed pocket beneath skin in aural region, about 1 inch (2.5 cm.) higher than normal ear, to allow for subsequent sagging. *C*, wound edges sutured and firm dressing applied to press skin against cartilage framework. A drain may be inserted in lower angle of wound and removed after forty-eight hours without disturbing firm dressing holding skin against cartilage. *Reproduced by courtesy of* **Plastic and Reconstructive Surgery** (3:*653, November 1948*).

reassured with regard to the child's hearing.

Deformity of The External Ear.—Severe congenital deformities of the auricle are usually associated with meatal atresia, but occasionally the canal and the drum membrane in a patient with such deformities are normal.

In the more extensive forms the auricle is completely absent except for the ear lobe, which is usually present but displaced forward or downward. The upper portion of the ear lobe may be intimately connected with a varying amount of distorted cartilage, which represents the underdeveloped cartilage of the auricle. There may also be a few small skin tabs, with cartilaginous understructure, situated in the cheek or in the neck. These are the so-called supernumerary auricles and represent abnormal

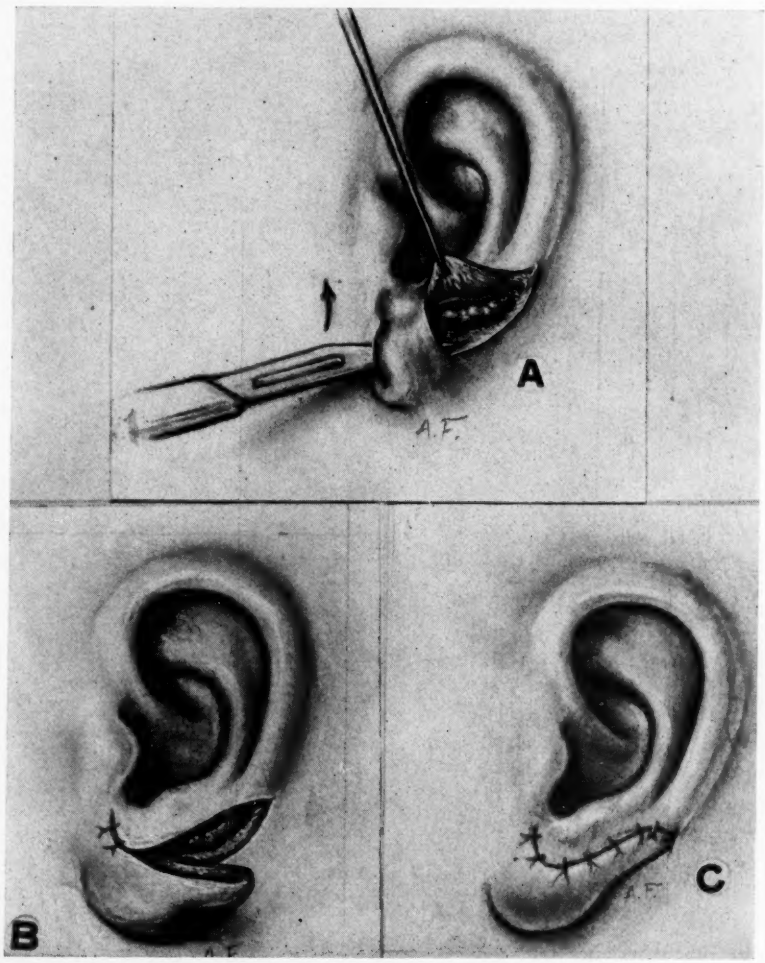

Fig. 3.—Adjustment of ear lobe into normal relation with reconstructed auricle using the principle of Z plasty. *Reproduced by courtesy of* **Plastic and Reconstructive Surgery** (3:*653, November 1948*).

growth originating from the branchial arches. Supernumerary auricles are also observed in association with entirely normal ears.

A great variety of less extensive auricular anomalies may occur, the mildest type being cleft of the lobule and absence or distortion of the tragus. A lowered hair-bearing scalp line, facial weakness and hemiatrophy of the face are often present on the affected side. A patient with hemiatrophy usually has a short ascending ramus, which causes malocclusion and other orthodontic conditions.

Reconstruction of the auricle in children may begin when the child is about 3½

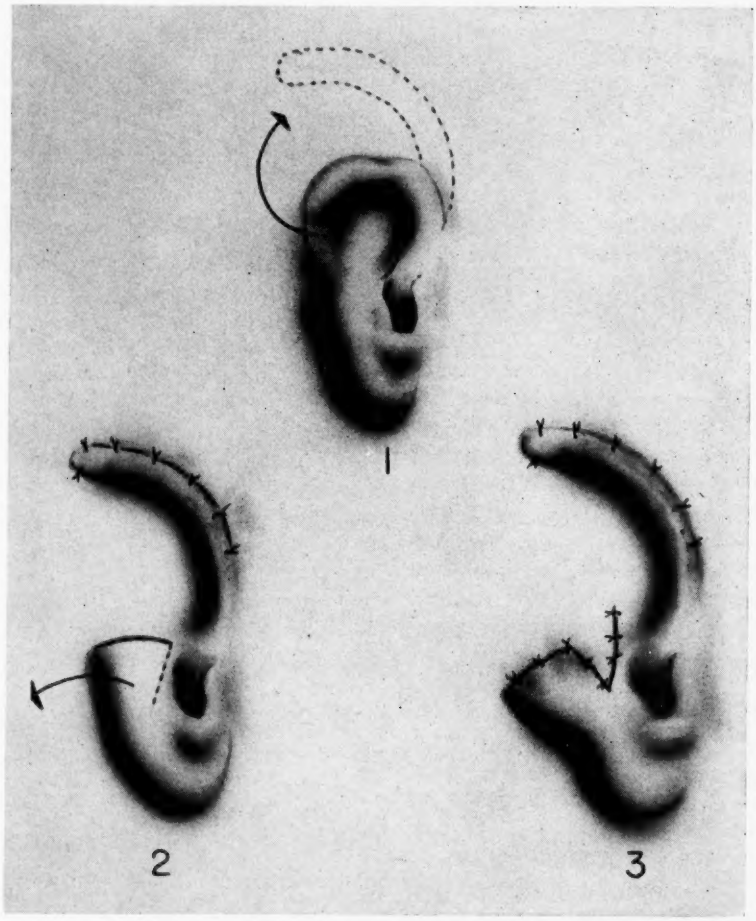

Fig. 4.—Drawing to show importance of using all available positions of auricle. When a small concha and helix are available, helix is detached and sutured at a higher level so that good relation is established with normal ear on opposite side. Small concha is widened by ever-useful Z plasty, and exposed edges of auricular cartilage are buried. Area of absent cartilaginous support is thus outlined by transplanted helix above and upper part of ear lobe below. Diced cartilage grafts or single segment of cartilage is later introduced to provide cartilaginous support. (*From Peer, L.A.: Transplantation of Tissues. Baltimore: The Williams & Wilkins Company, 1955, vol. 1, p. 130. Reproduced by courtesy of publishers.*)

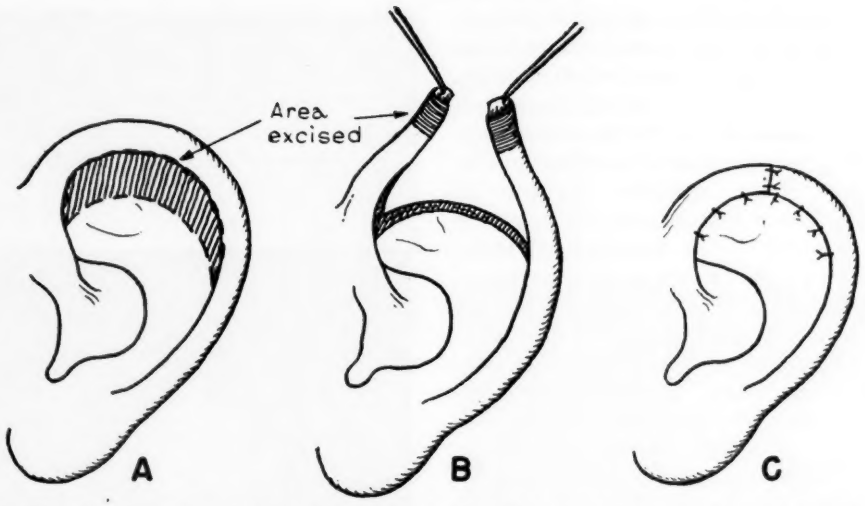

Fig. 5.—Sketch showing how height of reconstructed auricle or that of normal auricle may be reduced by excising a complete segment of cartilage and skin. The two auricles must match in height as well as angle.

years of age and has sufficient costal cartilage to provide structural support for the new auricle. The ear may thus be completed when the child is 5 years old, which enables him to enter school without a marked physical handicap and facilitates adjustment with other children. Since a child's ears are relatively large, the new auricle is made only slightly larger than the normal ear on the opposite side. If inequality in size develops later, the size of the larger ear may be reduced. Usually the larger ear will be the normal one, and it is relatively simple to reduce a normal ear so that it conforms in outline and contour with the reconstructed auricle.

Operative Technic. — Although reconstruction of an auricle is admittedly one of the most difficult problems facing the plastic surgeon, developments in this field during the past fifteen years have resulted in a general improvement of postoperative results. The technics used by different surgeons may appear somewhat diverse, but actually the basic principles are quite similar. In all auricle construction a framework must be provided for the new auricle in the region of the absent ear, and this framework must be covered with skin which, to an acceptable degree, conforms to the external contour of the framework. Transference of the ear lobe, which fortunately is usually present, into normal relations with the skin-covered framework, and the transplantation of skin to cover the posterior surface of the new auricle are standardized procedures.

Unfortunately, after this has been accomplished, some hair-bearing scalp skin is usually present on the upper portion of the new auricle, and a bald or hairless area of skin is seen above the auricle if an Esser inlay has been used. A hairless Wolf graft from behind the normal ear or from above the patient's clavicle may be used to replace the hair-bearing skin on the new ear, and hair-bearing scalp flaps may be brought down to substitute for the bald area above and behind the ear.

In centers where large numbers of auri-

cles are constructed the main difference in technic is in the type of material or tissue used for structural support of the auricle. In general, this consists of autogenous rib cartilage, preserved or fresh homogenous cartilage, preserved meniscus cartilage as a homograft, a composite structure of autogenous and homogenous cartilage and bone, or some sort of foreign body material such as the non-electrolyte metals or polyethylene. Our own experience during the past twenty-two years with the reconstruction of about 80 auricles has been limited to the use of the patient's own autogenous rib cartilage, and to preserved homogenous cartilage, either alone or in combination with autogenous cartilage.

We have constructed 65 auricles by using diced cartilage grafts pre-formed in a perforated vitallium ear mold. Autogenous cartilage has been used whenever it is present in sufficient quantity. In young children, however, and in some cases in which both auricles are absent, preserved bank diced cartilage has been used to supplement the patient's own cartilage.

Diced cartilage grafts[1] consist of small segments of cartilage that can be packed or molded into any desired contour, like wet grains of sand. The term "diced" is descriptive, but in practice the small segments are formed as flat shavings rather than cubes, because the former pack together without presenting sharp edges that might produce a prominence beneath the overlying skin.

Grafts of this type in a perforated vitallium mold (or any tolerated mold) will conform to the shape of the container.[2] When a perforated ear mold is filled with cartilage segments and buried beneath the patient's abdominal skin, connective tissue cells and blood vessels grow through the openings in the mold and fasten the separate segments together in the form of a solid plaque. If the mold remains in the recipient site for about five months, the cartilage segments will usually be fastened together by mature connective tissue cells with strong collagenous fibers, so that it can be removed from the mold as a solid ear structure. This cartilage framework

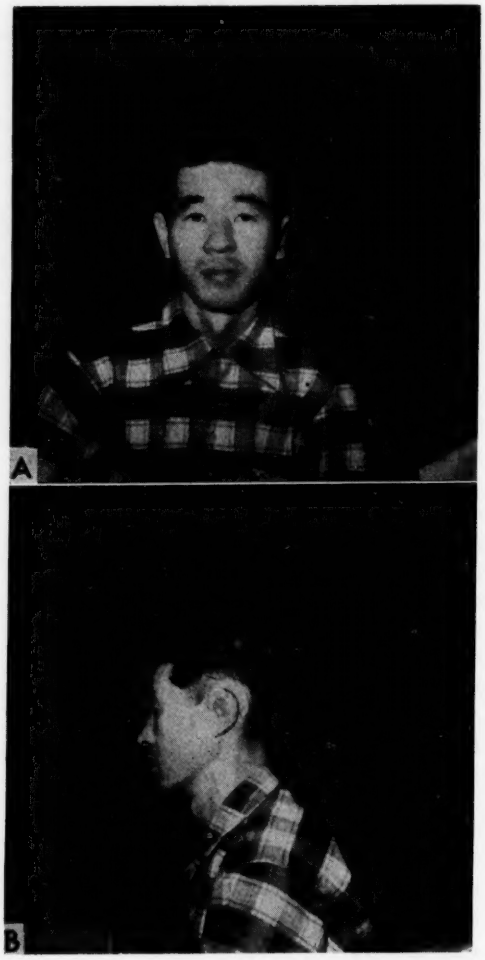

Fig. 6.—Patient with complete reconstruction of left auricle some years after final operation. This is typical of the average results obtained by vitallium ear mold method in author's first series. At conversational distance auricle is reasonably acceptable, but closer inspection shows a somewhat heavy structure with a hairless split skin—covered area above and behind ear.

Fig. 7.—Close-up photograph of patient with completely reconstructed auricle, demonstrating acceptable cutaneous conformation to diced cartilage framework. Photograph taken shortly after a Z switch to correct notching in ear lobe. At conversational distance, imperfections visible in photograph are less noticeable. Hairline was lowered by a Z switch.

may be inserted beneath the skin in the region of an absent ear to form the structural support for a new auricle.

Choice of Cartilage Grafts.—Fresh autogenous cartilage is always the material of choice for transplantation. This is especially true in reconstruction of the ear, because absorption or extrusion of homogenous, heterogenous or inorganic frameworks after the Esser inlay has been applied *will create an almost irreparable surgical problem.*

If homogenous cartilage grafts inserted to repair saddle nose or build out a receding chin are partly absorbed, the surgeon can always utilize an autogenous cartilage or bone graft to correct the deformity. When absorption or extrusion of an ear framework occurs after the auricle has been reconstructed, the new appendage contracts to a small unsightly nubbin. One must then remove the Esser inlay skin, suture the contracted covering skin back into contact with the hair-bearing scalp skin and begin the series of operations all over again.

Clinical and experimental evidence indicates that only autogenous cartilage should be used for reconstructing the auricles of young persons. Recent experimental work by Schofield[3] and Gibson and Davis[4] confirm our own observations[5] with regard to the behavior of homogenous and heteroge-

Fig. 8.—Patient with completely reconstructed auricle in which detail of ear structure is closer to normal and structure less bulky. This completely constructed auricle is among author's 15 most satisfactory results.

nous cartilage grafts in human tissues.

The selection of autogenous cartilage for the reconstruction of an auricle is much more important than the particular technic used by the surgeon. *Satisfactory external ears can be formed by methods other than the diced cartilage technic.* The experience of the surgeon and the use of autogenous cartilage are more important than the particular method employed.

Late Results.—In our hands the preformed diced cartilage framework has been satisfactory in about 80 per cent of 65 reconstructed auricles. The failures or unsatisfactory results were often due to poor management, and these, with few exceptions, occurred in the first 40 patients operated upon. Nine out of ten reconstructions completed in the past year have been satisfactory. In 1 patient the mold became infected owing to the presence of a broken-off piece of rubber drain inadvertently left in the transplantation site.

A critical evaluation of the successfully reconstructed auricles by the vitallium mold method demonstrated that patients and parents were generally pleased with the results. Children adjusted well in school and were accepted by their classmates as members of the group. Parents and older patients often desired to have more refined details made in the reconstructed ear, but none of our successfully treated patients were sorry that the ear had been made, in spite of the multiple operations and the hospital and medical expenses.

From the surgeon's standpoint, the reconstructed auricles in cases of unilateral involvement were generally satisfactory in contour, angle and lobe relation with the normal ear at conversational distances. Closer inspection always demonstrated a somewhat thick structure, with an absence of fine and accurate crura and concha outlines. Our bilateral reconstructions also were more satisfactory in the contour-

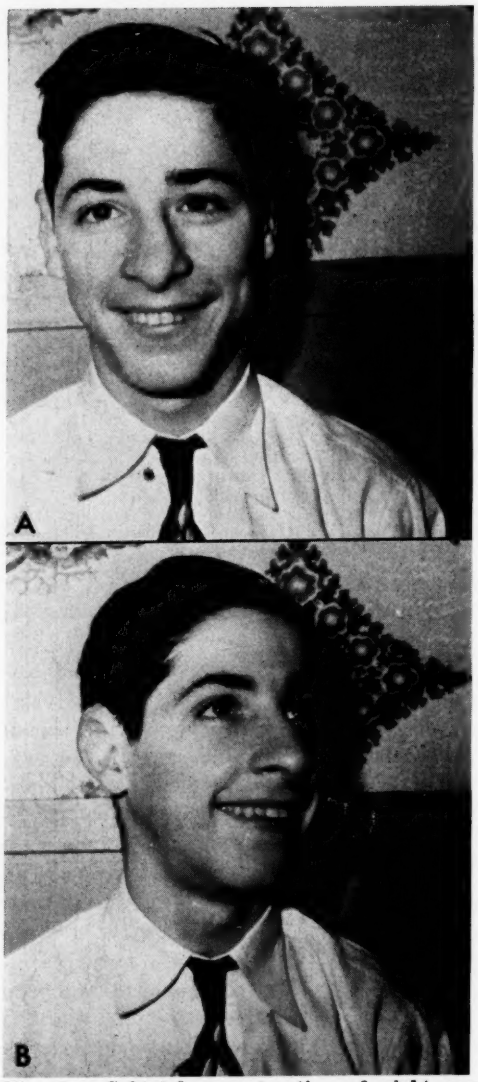

Fig. 9. — Subtotal reconstruction of right ear with diced cartilage. As has been stated, it is important to use all portions of the auricle which are present. When a small concha and helix are available, author detaches the helix and sutures it at a higher level, so that a good relation is established with the normal ear on the opposite side. The small concha is widened by the ever-useful Z plasty and the exposed edges of auricular cartilage buried. Thus the area of absent cartilaginous support is outlined by the transplanted helix above and the upper part of the ear lobe below. Diced cartilage graft or a single segment of cartilage is later introduced to provide cartilaginous support (Fig. 4).

angle-lobe relation than was detailed and refined reproduction of the normal auricular structure.

The most satisfactory auricles were those partially reconstructed in which a distinct but small concha was present, often associated with an ear canal and normal drum membrane.

CONCLUSIONS

Reconstruction of an auricle should be undertaken with caution *but not with excessive skepticism.* Perhaps the postoperative results are somewhat similar to those obtained from repair of complete bilateral harelip as regards the wide nostrils, short columella and flattened nasal tip. The constructed auricles, in most instances, also show obvious deficiencies in fine structure, but who will deny that both procedures are justified if the patient with an auricular deformity and the child with bilateral harelip are benefited in their integration and self-assurance?

There is a tendency for experienced and critical plastic surgeons to become discouraged by the numerous compromises necessary in total ear construction. These men are sometimes influenced to give up the use of relatively dependable autogenous cartilage as a supporting framework and utilize some form of inorganic material that can be accurately shaped before burial. Unfortunately, these foreign materials immediately beneath the skin appear to elicit more host reaction than do similar foreign transplants in the orbit, or those more deeply implanted as substitutes for absent segments of blood vessels. There are no long-term reports of satisfactory auricles in which inorganic materials were used for the framework.

This is not to state that experimental work with foreign implants should not be continued. More precise knowledge concerning the rejection of homogenous and heterogenous cartilage grafts and successful means to prevent this host reaction may be applied to the rejection of inorganic implants. Until this time arrives, however, the plastic surgeon should continue to use autogenous supporting tissue for reconstructing auricles, especially in children, who have a long life expectancy. Homogenous cartilage may be used for older patients when it is not deemed advisable to remove the costal cartilage, but the use of heterogenous cartilage from the ox or the sting ray is still in the realm of experimental surgery. When diced cartilage is used, a mixture of autogenous and homogenous shavings may actually be desirable, because gradual absorption of the homogenous cartilage tends to thin out the structure of the ear to some extent.

The possibility of removing the chondrocytes from cartilage and utilizing the matrix as a sort of "ideal homograft or heterograft" material without antigen qualities is fascinating but illusive. Attempts to synthesize a cartilage matrix or to inject substances that cause the host tissues to form cartilage have not been successful.

Workers in our Clinic are currently attempting to separate the chondrocytes from the matrix by a different approach, and this may eventually be accomplished. Homogenous and even heterogenous cartilage matrix without cells might provide a valuable grafting material, assuming that the foreign cells rather than the matrix are the antigens that cause the production of hostile antibodies.

SCHLUSSFOLGERUNGEN

Die Wiederherstellung des äusseren Ohres soll mit Vorsicht *aber ohne übertriebenen Skeptizismus* unternommen werden. Die Operationsergebnisse lassen sich vielleicht mit denen vergleichen, die man bei der Wiederherstellung einer voll-

ständigen doppelseitigen Hasenscharte zu erwarten hat; man denkt dabei an die weiten Nasenflügel, das verkürzte Nasenseptum und an die Abflachung der Nasenspitze. Das künstlich aufgebaute äussere Ohr weist ebenfalls in den meisten Fällen Unvollkommenheiten im feineren Bau auf. Kann man deswegen die Berechtigung zu diesen operativen Eingriffen ablehnen, wo doch ein Kranker mit einem entstellten Ohr oder ein Kind mit doppelseitiger Hasenscharte dadurch erheblich in ihrer äusseren Erscheinung und an Selbstsicherheit gewinnen können?

Bei vielen erfahrenen und kritisch eingestellten plastischen Chirurgen lässt sich eine Neigung feststellen, durch die häufig notwendigen Kompromisse beim völligen Wiederaufbau eines Ohres entmutigt zu werden. Sie werden manchmal beeinflusst, die Verwendung des verhältnismässig zuverlässigen autogenen Knorpels als Stützmittel aufzugeben und sich eines anorganischen Materials zu bedienen, das sich vor der Einnähung genau in die gewünschte Form modellieren lässt. Leider führen diese Substanzen, wenn sie unmittelbar unter der Haut liegen, offenbar häufiger zu Fremdkörperreaktionen, als es bei ähnlichen Transplantaten in der Augenhöhle oder bei tiefer gelegenen Ersatzstücken für fehlende Blutgefässabschnitte der Fall ist. Es liegen keinerlei Berichte über langdauernde zufriedenstellende Resultate mit künstlichen Ohren vor, bei denen als Stützsubstanz anorganische Stoffe verwendet wurden.

Der Verfasser will damit nicht sagen, dass Versuche mit körperfremden Transplantaten aufgegeben werden sollten. Genauere Kenntnisse hinsichtlich der Unverträglichkeit homogener und heterogener Knorpeltransplantate und hinsichtlich erfolgreicher Massnahmen zur Verbeugung der Fremdkörperreaktion lassen sich auf die Unverträglichkeit anorganischer Transplantate anwenden. Bis dahin aber sollten die plastischen Chirurgen weiterhin ein autogenes stützendes Gewebe zum Wiederaufbau des Ohres, besonders bei Kindern mit Aussicht auf eine lange Lebensdauer, benützen. Bei älteren Kranken, wo die Entfernung von Rippenknorpel unratsam erscheint, kann man homogenen Knorpel verwenden; die Anwendung heterogenen Knorpels vom Ochsen oder vom Stachelrochen gehört jedoch noch immer in das Gebiet der experimentellen Chirurgie. Bei der Benützung von Knorpelstückchen ist vielleicht eine Mischung autogener und homogener Splitter wünschenswert, weil die allmähliche Absorption des homogenen Knorpels zu einem gewissen Grad der Verdünnung des Ohrgebildes zu führen scheint.

Die Möglichkeit, die Chondrozyten aus dem Knorpel zu entfernen und nur die Grundsubstanz als eine Art "idealen homogenen oder heterogenen Transplantationsmaterials," das nicht die Eigenschaften eines Antigens besitzt, zu verwenden, ist eine faszinierende aber trügerische Idee. Versuche, ein Transplantat aus Knorpelgrundsubstanz herzustellen oder Stoffe einzuspritzen, die das aufnehmende Gewebe zur Knorpelbildung anregen, haben keine Erfolge gezeigt.

Mitarbeiter des Verfassers sind augenblicklich mit Versuchen beschäftigt, die Chondrozyten auf anderem Wege von der Grundsubstanz zu trennen, und vielleicht wird sich das schliesslich erreichen lassen. Wenn man annimmt, dass die fremden Zellen (und nicht die Grundsubstanz) die Antigene sind, die zur Bildung von Antikörpern führen, darf man hoffen, dass die homogene und sogar die heterogene Knorpelgrundsubstanz ohne Zellen ein wertvolles Transplantationsmaterial abgeben mag.

CONCLUSIONES

La reconstrucción de una aurícula debe tomarse con cautela *pero no con escepti-*

cismo exagerado. Talvez los resultados postoperatorios sean similares a los obtenidos por reparación completa de labio leporino bilateral en lo que respecta a ventanas nasales amplias, tabique corto y punta de la nariz aplanada. La aurícula construída en la mayoría de los casos, también muestra deficiencias obvias en cuanto a estructuras finas, pero ¿quién puede negar que ambos procedimientos operatorios se justifican si tanto un paciente con deformidad de una aurícula, como un niño con labio leporino bilateral se benefician en su integridad y confianza en sí mismos?

Hay tendencia entre los cirujanos plásticos con experiencia y crítica, de sentirse desalentados por los numerosos requisitos necesarios en la reconstrucción total de la oreja. Estos hombres son influenciados a no usar el relativamente buen cartílago autógeno como un marco de soporte y a usar alguna forma de material inorgánico que pueda moldearse cuidadosamente antes de ser cubierto. Desafortunadamente, estos materiales extraños immediatamente debajo de la piel parecen estimular más reacción en el huésped que los transplantes extraños similares usados en la órbita, ó más profundamente implantados como sustitutos de segmentos ausentes de vasos sanguíneos.

No hay reportes a largo plazo de aurículas satisfactorias en las que se hayan usado materiales inorgánicos para construir el marco de la oreja.

Esta no quiere decir que los trabajos experimentales con implantes extraños deban suspenderse. Un conocimiento más preciso respecto a la expulsión de injertos de cartílago homogéneo y heterogéneo y métodos efectivos para prevenir esta reacción del huésped puede aplicarse a la expulsión de implantes inorgánicos. Mientras este tiempo llega, sin embargo, el cirujano plástico debe seguir usando tejido de soporte autógeno para la reconstrucción de aurículas especialmente en niños que tienen una larga vida por delante. Cartílago homólogo puede usarse en pacientes mayores cuando no se considera aconsejable remover cartílago costal del paciente, pero el uso de cartílago heterogéneo del buey ó de la raya marina están aún en vías de cirugía experimental. Cuando se usa cartílago cortado, una combinación de cortes autógenos y homogéneos puede ser deseable, porque la absorción gradual del cartílago homogéneo tiende a adelgazar la estructura de la oreja en cierto grado.

La posibilidad de remover los condrocitos del cartílago y utilizar la matriz como un tipo "ideal de homoinjerto ó heteroinjerto" sin cualidades antígenas es fascinante pero ilusorio. Los intentos de sintetizar un injerto de matriz de cartílago ó la inyección de sustancias que estimulen el tejido del huésped a formar cartílago, no han tenido éxito.

En la clínica del autor, se está tratando constantemente de separar los condrocitos de la matriz por diferentes vías y alguna vez talvez pueda lograrse.

La matriz de cartílago homogéneo y aún heterogéneo, sin células puede proveer un valioso material de injerto, si se considera que son las celulas extrañas (y no la matriz) los antígenos que causan la producción de anticuerpos hostiles.

CONCLUSIONS

La reconstruction du pavillon de l'oreille devrait être entreprise avec une certaine prudence, mais *sans scepticisme excessif.* Peut-être les résultats post-opératoires peuvent-ils en un certain sens être comparés avec ceux obtenus lors de la réparation d'un bec-de-lièvre total bilatéral en ce qui concerne les narines élargies, la columelle courte et l'extrémité aplatie du nez. Le pavillon reconstruit montre aussi, dans la plupart des cas, des déficiences nettes pour ce qui est des structures fines.

Mais il est indéniable que les deux opérations sont justifiées puisqu'elles apportent au malade atteint soit d'une déformation du pavillon soit d'un bec-de-lièvre bilatéral, une amélioration aussi bien esthétique que psychologique.

On constate chez les chirurgiens plastiques expérimentés et critiques, une tendance au découragement devant les nombreux compromis nécessaires en cas de reconstruction totale d'une oreille. Ces spécialistes sont parfois enclins à renoncer à l'usage d'un cartilage autogène relativement sûr comme charpente de soutien, pour lui préférer une forme quelconque de matériel inorganique pouvant être moulé avec précision avant son implantation. Malheureusement ces corps étrangers implantés immédiatement sous la peau semblent provoquer plus de réactions antagonistes que les greffons similaires placés dans l'orbite ou implantés plus profondément en tant que substituts de segments de vaisseaux sanguins. La littérature ne mentionne pas de résultat satisfaisant à longue échéance concernant l'emploi de matières de soutien inorganiques pour la reconstruction de l'orreille.

Cela ne signifie pas que ces expériences doivent être abandonnées. Une connaissance plus précise des réactions antagonistes provoquées par les greffes de cartilage homogène et hétérogène, et des moyens propres à les prévenir, est nécessaire. Jusque là cependant, le spécialiste devrait continuer à employer une charpente autogène pour la reconstruction du pavillon, spécialement chez les enfants, qui ont une longue vie devant eux. Le cartilage homogène peut être utilisé chez les malades plus âgés quand il paraît contre-indiqué de prélever du cartilage costal, mais le cartilage hétérogène de boeuf ou de pastenague est encore du domaine de la chirurgie expérimentale. Lorsqu'on utilise du cartilage strié, un mélange de "débris" autogènes et homogènes peut actuellement être souhaitable, car l'absorption graduelle de cartilage homogène tend à amincir dans une certaine mesure la structure de l'oreille.

La possibilité d'éliminer les chondrocytes du cartilage et d'utiliser la matrice comme une sorte de matériel "d'homogreffe ou d'hétérogreffe idéale" sans réactions antigènes, est séduisante mais illusoire. Les tentatives en vue de synthétiser un greffon de matrice de cartilage ou d'injecter des substances amenant le greffon à former du cartilage n'ont pas été couronnées de succès.

Des collaborateurs de l'auteur poursuivent dans sa clinique des travaux afin de séparer les chondrocytes de la matrice, au moyen de techniques variées. Ces travaux peuvent éventuellement aboutir à un résultat. Une matrice de cartilage sans cellules, homogène et même hétérogène, pourrait donner un matériel de greffe u t i l i s a b l e, à condition que les cellules étrangères (plutôt que la matrice) soient les antigènes provoquant la production d'anticorps.

CONCLUSOES

A reconstrução do pavilhão auricular devia ser realizada com receio *mas não com excessivo cetimismo.* Os resultados pós-operatorios são, talvez, semelhantes aos obtidos pela reparação de uma fissura pre- alveolar bilateral no que tange a amplitude das narinas, a uma columela curta e uma aza nazal achatada.

A reconstrução auricular obviamente demonstra, em muitos casos deficiências nos relevos mais delicados mas quem negaria justificativa para operar uma criança com deformidade de orelha ou com una fissura bilateral do lábio, considerando o beneficio de sua re-integração social ou de sua rehabilitação?

Há uma tendência entre os cirurgiões plasticos experientes e críticos para desa-

nimarem em face de numerosos estágios exigiveis para reconstrução total do pavilhão. Esses cirurgiões são influenciados muitas vezes a abandonar o uso relativamente seguro da cartilagem autógena como esquelêto para recorrer aos tipos de material aloplástico porque podem ser facilmente modelados antes da inclusão. Tais substâncias estranhas, infelizmente, quando colocadas sob a pele, suscitam mais reação do que quando usados no protese ocular ou então quando são uzados como substituto de segmentos vasculares mais profundamente situados. Não existe ainda um tempo suficientemente longo para se avaliar os resultados dessas inclusões como estrutura de pavilhão auricular. Tal fato não significa que se deva deixar de proseguir no trabalho experimental sobre as inclusões. Um conhecimento mais preciso sobre a intolerancia de enxertos homogenos e heterogenos de cartilagem e os meios de corrigir ou de prevenir essas reações poderão ser aplicados a rejeição das inclusões inorgânicas.

Até que se consiga atingir essa fase os cirurgiões plásticos devem continuar a usar as cartilagens autogenas para reconstrução do pavilhão auricular, sobretudo nas crianças, que têm uma longa vida a desfrutar. A cartilagem homogena pode ser utlizada nas pessoas idosas nas quais não é aconselhavel remover material, recorrendo-se aos tranplantes de cartilagem bovina ou de barbatana dorsal (de Masticura) como objeto de cirurgia experimental. Quando se usa material picado pode-se miturar cartilagens autoge e homogena porque a absorção gradual do enxêrto homogeno tende a afinar o esqueleto da neo-orelha. A possibilidade de remover os condrocitos da cartilagem e usar a matriz como uma especie de "enxerto homogeno ou auterogeno ideal" sem qualidades antigênicas é fascinante porem ilusória. As tentativas de sintetizar um enxêrto de cartilagem mater ou de injetar substâncias capazes de promover no receptor a formação de cartilagem não foram bem sucedidas. Os colaboradores da clínia do A. continuam tentando isolar os condrócitos por nova técnica e talvez cheguem a conseguir. A cartilegam matriz quer dos homogenos como dos heterogenos privada de células pode prover valioso material para enxertia (possivelmente melhor que a propria matriz) considerando-se que as celulas extranhas sejam os antigenos que suscitam a produção de anticorpos no organismo do receptor.

CONCLUSIONI

La ricostruzione dell'orecchio deve eseser intrapresa con cautela ma non con eccessivo scetticismo. I risultati operatori sono forse paragonabili a quelli che si ottengono con la cura del labbro leporino completo bilaterale, nei rigaurdi delle narici ampie, della columella breve e della punta del naso piatta. Anche la ricostruzione dell'orecchio, in molti casi, mostra delle evidenti deficienze, ma chi può negare che entrambi gli interventi non siano giustificati se un paziente con una deformità dell'orecchio o un bambino con un labbro leporino bilaterale ne potranno trarre un beneficio?

Vi è una certa tendenza fra i chirurghi plastici a scoraggiarsi di fronte ai numerosi compromessi necessari per la ricostruzione totale dell'orecchio. Alcuni sono portati ad abbandonare l'uso di trapianti cartilaginei autoplastici (come strutture di sostegno) per utilizzare materiali inorganici che possono essere modellati prima dell'uso.

Sfortunatamente tali materiali innestati subito sotto la cute sembrano scatenare reazioni maggiori di quanto non avvenga in sedi più profonde come l'orbita o anche per i trapianti vasali. Non vi sono controlli a distanza soddisfacenti di orecchie in cui si sia usato qualche materiale inorganico come sostegno.

Questo non significa che esperienze su questa linea debbano essere abbandonate; una conoscenza pià approfondita sulle cause dell'eliminazione di questi trapianti cartilaginei omologhi ed eterologhi e sui mezzi per evitarla potrà essere applicata anche ai trapianti inorganici.

Ma fino a che non arriverà questo momento il chirurgo plastico dovrà continuare a usare come mezzi di sostegno dei tessuti autologhi per ricostruire le orecchie specialmente nei bambini. Le cartilagini omologhe potranno essere usate nei pazienti più anziani in cui non è consigliabile asportare cartilagini costali, mentre quelle eterologhe rimangono ancora nel domino della chirurgia sperimentale. Quando si usino blocchetti di cartilagine è consigliabile usare una mescolanza di frammenti autologhi ed omologhi, poichè il graduale riassorbimento di questi ultimi tende a ridurre lo spessore dell'orecchio.

La possibilità di isolare i condrociti dalla cartilagine e di usare la matrice come una specie di trapianto ideale sprovvisto di potere antigene è un'ipotesi interessante ma non realizzabile. Del pari non è stato possibile sintetizzare una matrice di cartilagine o iniettare sostanze capaci di stimolare la produzione di tessuto cartilagineo da parte dei tessuti ospitanti.

Ricerche sono in corso per tentare di separare i condrociti dalla matrice con vari metodi, e forse ciò potrà essere possibile. Matrici di cartilagine emologa ed eterologa, senza cellule, possono rappresentare un utile materiale da innesto poichè proprio le cellule (più della matrice) rappresentano gli antigeni capaci di provocare la formazione di anticorpi.

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One of the most important features of a good teacher is that the students should have free and ready access to him. In too many departments, particularly where the senior staff are much occupied with research or administration, they appear to the students as remote Olympians, momentarily descending from the heights to deliver a lecture or to administer an examination. To take one's difficulties to such a preceptor would savour of impropriety.

—*Sinclair*

Fractures of the Upper and Lower Jaws

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FRACTURES of the maxillofacial region are significant because of their proximity to the base of the skull, orbit, maxillary sinus and nasal fossa. It is important that these fractures be treated properly at the time of injury or as soon thereafter as possible. Undue delay, until bones have undergone ossification in faulty relations, will tend to cause malocclusion and disfigurement. In such a case correction at a later date is accomplished only by means of tedious and multiple operations, and deformity may result which subsequent surgical measures will be unable to correct satisfactorily.

This paper is confined to a discussion of reduction, immobilization and fixation of fractures of the bony tissues of the upper and lower jaws, and various methods of treatment in modern use. Such important aspects as etiology, diagnosis, symptoms and characteristics, soft tissue injuries and their treatment, and the whole subject of bone grafting and definitive reconstruction of the jaw will be discussed in subsequent articles.

Early care of fractures of the upper and lower jaws calls first for an immediate appraisal of the patient's general condition; the first concern is control of hemorrhage and shock. Until shock has been relieved, or when evidence of cerebral damage exists or is suspected, reduction and fixation should be postponed until the patient's condition has been evaluated. During this waiting period the fractured jaw or jaws should be immobilized with some form of emergency bandage. The only exception to postponement is control of concurrent massive bleeding.

Next, the fragments should be immobilized and placed in such apposition that when they are united the anatomic norm and full function, or at least the best possible have been restored. The basic principle is the same for both superior and inferior maxillary fractures, i.e., fixation of the dental arches in normal occlusion.

A large proportion of facial fractures are compound and may be infected, but the infection is superficial, and body immunity will usually care for it. With certain fractures, drainage may become necessary as a precautionary measure.

Methods and Devices for Reduction.—The appliances and methods in general use today for immobilization and fixation of the fractured jaws are varied and numerous. Mention of the more important of these devices and observations on the technic of their application follow.

Intermaxillary wiring is a satisfactory and simple procedure for fixation, doing away with the discomfort incident to the taking of impressions and the fitting of splints. Its use, however, is dependent upon the presence of a sufficient number of good teeth in the upper and lower jaws for anchorage. It requires no complicated apparatus, and the application of wires is simple and rapid. The teeth are in full view throughout the procedure, and occlusion can be constantly observed.

Should the wires become loosened, they

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Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.

Submitted for publication Oct. 1, 1956.

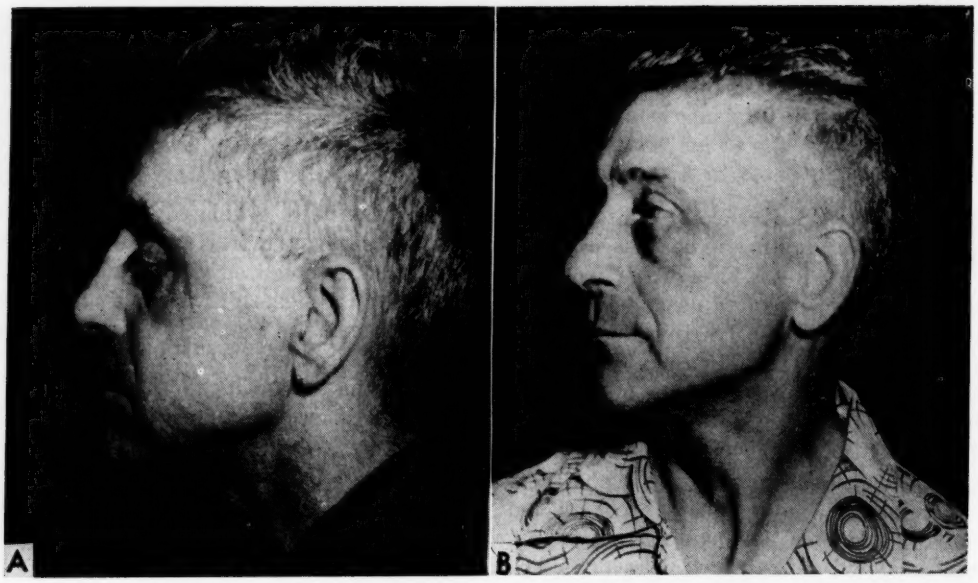

Fig. 1.—Infraorbital ridge restored by cancellous bone graft from ilium, raising infraorbital ridge and restoring orbit.

can be tightened when necessary or advisable. Disadvantages of the method are that the closed bite may interfere with drainage, mastication and oral hygiene; the anchoring teeth may tend to loosen from the traction of the wires, and foreign bodies next to the gums may cause gingivitis. On the other hand, in the event of emergency, the wires can be quickly cut and the mouth opened. The use of wires for immobilization of the jaws, with the existing teeth serving as anchorage, was first reported by Gilmer[1] in 1887.

Circumferential wiring is a technic particularly applicable when the teeth are either absent, too few or too insecure to afford attachment for the wires, or when the angle of the fracture is such that circumferential wiring will hold the proximal and distal fragments together. With this method the wires are wound around the body of the bone and twisted over a splint fitted to the lower alveolar ridge, (Black[2]). After reduction of the fracture an impression is taken, and from this a cast is made of vulcanite, acrylic plastic or metal to fit over the alveolar ridge beyond the fracture on either side.

Buccal arch bars, introduced by Gilmer[3] and Sauer[4] and modified by Winter[5], are used for patients with an incomplete complement of teeth, or when the teeth are carious or so arranged as to make it difficult to hold the fracture in alignment. Arch bars are also employed when teeth are present in both fragments of the mandible and the maxilla is edentulous.

The arch bar is bent to conform to the shape of the dental arch after the fracture has been reduced and is then fastened to the teeth with fine-gauge wire, either to the maxilla or the mandible, or both, depending upon the situation at hand.

Cast splints have furnished excellent results, particularly when only a few teeth remain in the fragment. These splints, first described by Hullihen,[6] often provide necessary immobilization when attached

only to the mandible, permitting opening and closing of the mouth. Nevertheless, the method has its disadvantages; the complexity of construction and application, the necessary equipment and the expense to the patient. These splints may be reserved for fractures posterior to the third molar; when there are only a few teeth present in each fragment; for comminuted fractures with loss of bone, and when fixation over a period of months is required.

Acrylic splints are useful in cases of extensive loss of bone, when fragments must be held in normal position until a bone graft can be placed and consolidated. The advantages of acrylic material over vulcanite and silver are that it is inconspicuous; it permits observation of gingival tissue, and it is radiolucent and light in weight.

The multiple loop intermaxillary elastic traction of Stout for reduction is easily modified to fit most situations when teeth are present, and may be combined with buccal arch bars, circumferential wiring and splints of various types. The advantages of this method are its simplicity, ease of application, cleanliness, and ease of alignment. In addition, the armamentarium necessary is minimal.

Direct wiring, it is generally agreed, should be limited to selected patients, especially for fractures of the mandible, which are practically all compound. Direct wiring adds a foreign body, but it is valuable for fixation of the fragments when there is difficulty in holding them in position when open reduction is required.

External pin fixation has its chief application when ordinary splints, intermaxillary wiring or other simple appliances cannot be used, or when intra-oral anchorage is inadequate.

In using external skeletal fixation, there are certain anatomic points to bear in mind. With the mandibular canal extending about halfway between the apices of the teeth, the inferior border of the mandible should be avoided. A dense cortical

Fig. 2.—Fractures of alveolus of maxilla and mandible.

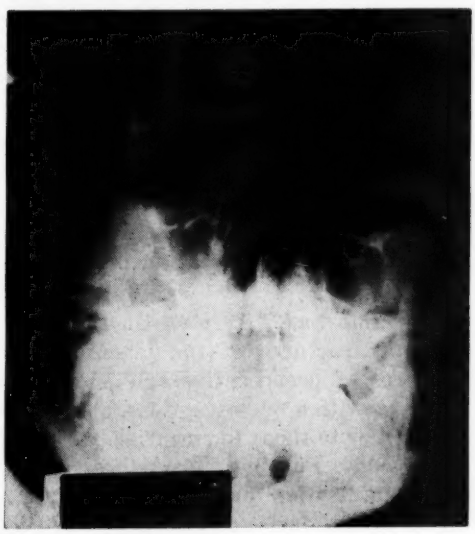

Fig. 3.—Transverse fractures of maxilla with downward displacement.

bone of the mandible will admit screw fixation. Before any attempt is made to insert the pins, careful roentgenographic studies should be made on the plates to indicate the exact location of the fracture line and the amount of displacement. The pins should be inserted under sterile conditions and the use of high speed drills avoided because of the heat they generate.

The depth of insertion of the pin should be predetermined by marking the proper level with a small piece of rubber tubing. At least two pins should be placed in each fragment, both located at a minimum distance of 1 cm. from the fracture line. The two pins are joined by a connecting device, the bone fragments manipulated into position, and the universal joint and secondary bars applied and securely locked in place.

Many methods employing external fixation are based upon the Roger Anderson[7] pin unit principle introduced by Converse.[8] In my own experience, complications with this method have been rare. Those which did occur were loosening of the pin and mild local cellulitis, each of which cleared spontaneously on removal of the pins.

Internal pin fixation with the Kirschner type wire was introduced by Brown.[9] The wire is placed directly across the fracture line and holds the two fragments in position.

Reduction and Fixation.—In the treatment of fractures of the jaws, routine measures of preoperative and postoperative care, with a few exceptions, are generally similar to those for injuries elsewhere in the body. For these procedures, either block, infiltration or endotracheal anesthesia is satisfactory; I employ them all for their separate indications. Only light preoperative medication is administered, lest the patient's respiratory efforts be hampered.

Fractures of the Upper Jaw: Reduction and fixation of fractures of the superior maxilla are based upon the available points of fixation peculiar to the specific fracture, rather than upon the level at which the fracture occurs. Union occurs rapidly in impacted fractures of the maxilla, and for this reason reduction must be effected at an early stage. Complete reduction of the floater types may be performed by intermaxillary elastic traction, or by intermaxillary wiring, without anesthesia. For many patients, adequate fixation is obtained by fixing the upper jaw to the lower, and only for the extremely mobile fracture is external fixation required. When the fracture is seen late it may be necessary to camouflage the deformity by means of a reconstructive operation (Fig. 1).

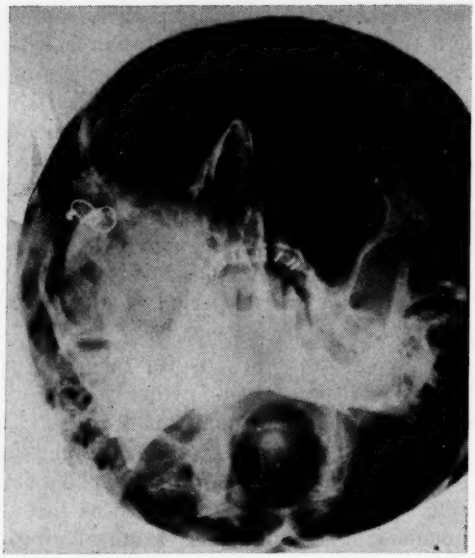

Fig. 4.—Compound comminuted fracture of zygomaticus with displacement downward and backward. Also compound comminuted fracture of zygoma. Antrum packed through Caldwell-Luc incision for splinting.

Fracture of the Aveolar Process: Fractures of the alveolus quite frequently result from tooth extraction. The teeth sometimes accompany the fragment, or they may remain in the main body of the bone. They may be undamaged, or their crowns

may be broken off and their roots fractured. The crowns of the teeth may be fractured at the level of the gingival margins, or forced out of their sockets; the alveolar bone may be comminuted and the affected teeth devitalized. Badly damaged teeth should be removed, and any sequestrum of the alveolar process completely detached from the periosteum should be eliminated. Because of its good blood supply, alveolar bone has an excellent chance to survive if not detached.

The most difficult displacement is that in which the alveolus has been driven and impacted into the maxillary antrum. If this is irreducible, surgical intervention is indicated (Fig. 2).

When the alveolus is not displaced, it is sufficient to fix the fragment with buccal arch bars, immobilizing it for thirty days. This fixation can be applied to fractures of either the upper or the lower jaw. When the line of fracture assumes a horizontal course and involves only the alveolar process, treatment is chosen according to the relation of the line of fracture to the roots of the teeth. If the fracture passes across the occlusal or incisional half of the dental roots, no treatment is required and the teeth may be retained.

Horizontal Maxillary Fracture: In cases of complete transverse fracture there is separation of the lower maxillary fragment from the rest of the maxilla. Displacement of the fragments may be downward, and because of looseness of the fragments the teeth may be in normal occlusion. Lateral and posterior displacement, with disturbance of occlusion, is not uncommon. Impacted fragments may be encountered. Upward displacement will usually be observed in the impacted fragment.

When the fragment is displaced downward the maxilla is generally loose, and palpation and manipulation will demon-

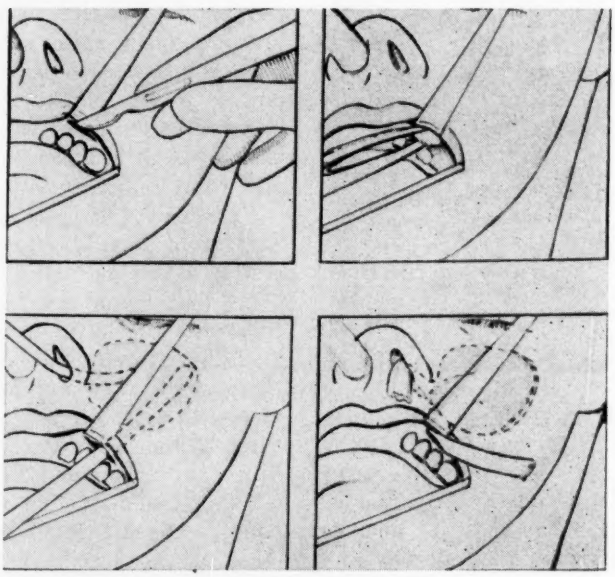

Fig. 5.—Caldwell-Luc opening and packing of antrum with iodoform gauze, bringing gauze out either through oral opening or through an inferior opening in nose. (*Reproduced by permission of the Illinois State Medical Journal.*)

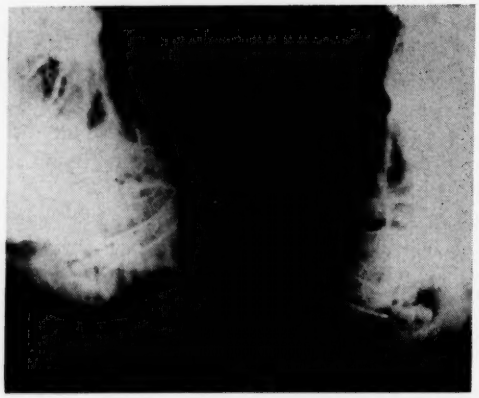

Fig. 6.—Buccal arch bars applied to teeth for fixation of fracture with unstable teeth.

Fig. 7.—Edentulous upper jaw. Kingsley splint used for fixation.

strate the fracture line. Multiple loop elastic traction will hold the fragment in normal anterior-posterior position and occlusion (Fig. 3). Upward pressure will be required to maintain the fragments in apposition. This may be accomplished by using a modified Barton's bandage, with a few elastic bands stretched over the bandage in front of the ear, the elastic bands being supported by safety pins. Such fractures heal rapidly, and fibrous union is accomplished within fourteen to twenty-one days.

Lateral, downward and backward displacement is more serious, involving the nasal and zygomatic bones. The line of fracture here extends through the root of the nose, through the floor of the orbits, and down and back through the pterygoid processes and the sphenoid bones. Reduction is accomplished by bringing the upper and lower teeth into occlusion. Elastic traction applied to the teeth by means of a buccal arch bar or multiple loop intermaxillary traction will bring the fragments into place in a reasonably short time, with little discomfort to the patient. Gravity is counteracted after occlusion with a modified Barton's bandage placed as previously described. If there are lacerations of the soft tissue, or teeth are lacking in either the upper or the lower jaw, a Kingsley splint may be used for the upward pressure necessary to offset the pull of gravity on the soft tissues. Fixation for fourteen to twenty-one days will usually result in fibrous union, bony union may result only after a long period.

Fracture of the maxillary bones may vary from an injury to the alveolar process to a tearing loose of all of the facial bones by a transverse fracture at or near their attachment to the cranium. These maxillary fractures, because they are contiguous with the cranium are often associated with extensive brain injury and fractures of the brain case. Transverse fractures are compound. They may occur through the middle portion of the nasal bones, extend through the frontal processes of the maxilla, and produce backward displacement of the maxilla and nasal bones in the lower portion. In the presence of such a fracture, when complete,

Fig. 8.—*A*, fracture through third molar tooth. *B*, tooth removed, direct wiring open reduction applied, with multiple loop intermaxillary elastic traction.

the bony framework below the fracture will sag, owing to the pull of gravity. The maxilla supports only the muscles of expression, and for this reason there is less displacement than in bones with heavy muscular attachment (Fig. 2).

Craniofacial Disjunction: It is in the transverse facial fracture that basal fractures are most likely to be encountered. There are many instances in which the entire face can be seen to move on the cranium when force is applied on the teeth.

The pyramidal process of the maxilla and zygoma may remain attached to the maxilla, and the middle portion of the face may be completely detached from the skull. This type of fracture is known as a craniofacial disjunction. Treatment requires neurosurgical intervention for brain damage and rhinorrhea. The cranial injury should assume priority, because of the possible complications. After the neurosurgical treatment the fracture will be manipulated into position and reduced as are other fractures in the middle third of the face.

Fracture of the Zygomaticus: This fracture is often unrecognized because of swelling in the soft tissues. If displacement is only moderate, slight flattening of the cheek results. Diplopia, with severe displacement and restriction of the mandible, occurs when displacement of the zygomaticus is downward (Fig. 4). Diplopia may be caused by temporary swelling of the soft parts or by damage to Tenon's capsule if permanent. The maxillary sinus may be filled with blood from injury to the mucosa, and in a comminuted fracture bony spicules, débris, and foreign bodies may be present.

The method of treatment may be any one of several. For the intraoral approach an incision is made in the buccal mucosa above the tuberosity of the maxilla on the affected side, and an elevator is passed up behind the malar bone. The bone is then elevated upward and outward. On reduction the operating surgeon will notice a definite "give" when the bone enters into position.

A temporal approach described by Gillies and his associates[10] is made through an incision in the scalp, about 2 cm. long,

through the temporal fascia. The space between the temporal fascia and temporal muscle leads directly under the zygomatic arch to the medial surface of the bone. A long, flat elevator is inserted, and by means of leverage, with the instrument resting on the posterior margin of the scalp incision and the skull, the zygomatic bone is elevated into its original position.

Compound Comminuted Fracture of the Zygomaticus: With this type of fracture the maxillary sinus must be evacuated of bone splinters, and support must be provided. Associated soft tissue injuries are always present, and immediate treatment requires removal of all foreign bodies, débris and devitalized hard and soft tissues. The sinus is opened through a Caldwell-Luc incision and explored and the bony spicules and hematoma removed. The displaced fragments are then manipulated into position. After the maxillary sinus has been evacuated and the fragments are in position, support is necessary to hold them in place. If it is desired to close the oral opening into the sinus, the packing may be brought out through an opening under the inferior turbinate of the affected side (Fig. 5). I prefer to bring the pack out through the oral opening. The cavity of the sinus is packed in slight overcorrection with iodoform gauze, most of the iodoform having been washed out in physiologic solution of sodium chloride. The packing is left for approximately ten days, after which it is removed from the sinus.

Unilateral Fracture: Unilateral fractures in which displacement is minimal can usually be reduced manually and immobilization produced by intermaxillary wiring or by the placement of buccal arch bars plus intermaxillary wiring. Immobil-

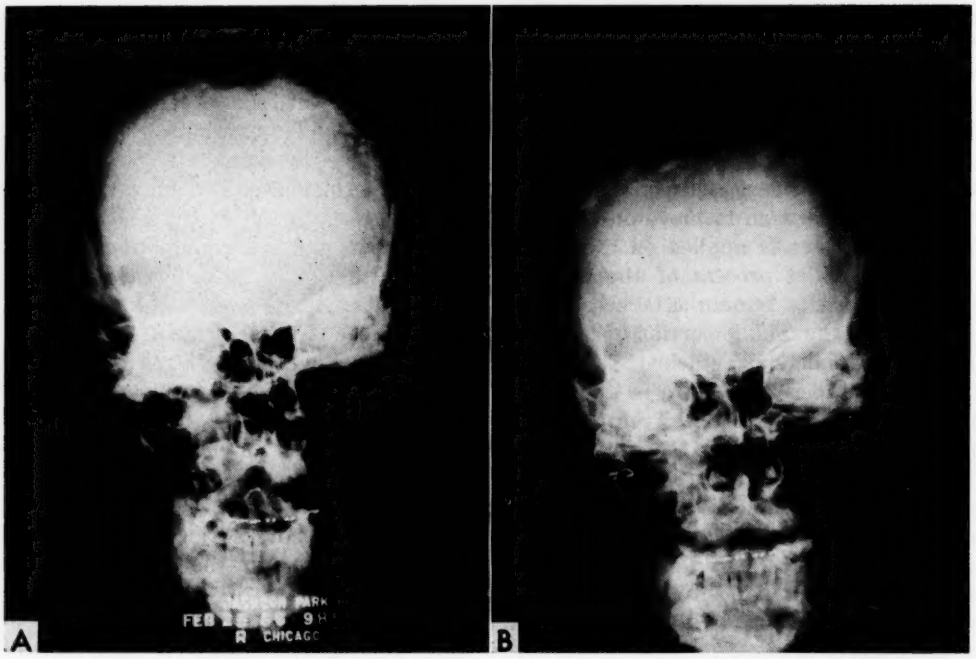

Fig. 9.—*A*, fracture of condyle. *B*, fracture reduced with open reduction and wiring.

ization for twenty-eight to thirty-five days is usually required.

Unilateral fractures with considerable displacement can, as a rule, be reduced by a lateral pull applied to an arch bar attached to the loose fragment. On lateral displacement the loose fragment will be displaced downward, resulting in an open bite. This may be corrected by some form of intermaxillary wiring. The most satisfactory results are obtained by placing a buccal arch bar on the lower teeth (Fig. 6) and applying elastic traction between the upper and lower teeth, correcting the downward displacement. When the loose fragment has been replaced for a day or two, the elastic bands are applied between the upper and the lower jaw and held in place for four to five weeks.

Old Depressed Fracture of the Zygomaticus: Displaced fractures of the zygomaticus with impingement on the coronoid process of the mandible are frequent. They are easily overlooked for a time after injury because of excessive swelling and ecchymosis of the overlying soft tissues. Such a fracture can be reduced soon after the injury; if it is not, conspicuous flattening of the cheek and restriction of motion of the mandible ensue.

Fig. 10.—Comminuted fracture of ramus reduced with Lane plate, internal wiring and multiple loop intermaxillary elastic traction.

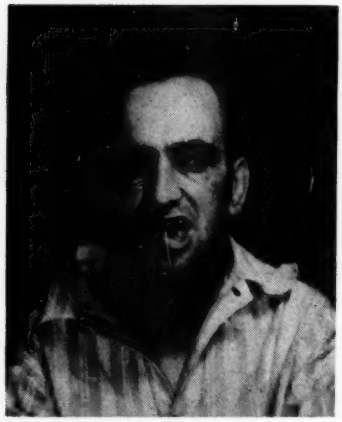

Fig. 11.—Hullihen splint used to control posterior fragment.

Spontaneous healing of this type of fracture, with fixation of fragments, occurs within two weeks. Reduction, therefore, should be instituted early. Failure to reduce such a fracture, which obstructs the excursion of the mandible by impingement of the coronoid process against the depressed zygomaticus, results in permanent inability to open the mouth. Refracturing of the depressed zygomaticus and attempted repositioning usually accomplishes little.

In a former publication[11] I described a method of approach, i.e., to accept the depression as it has solidified and restore the facial contour either with rib cartilage or with cancellous bone. (This also I have previously discussed.[12]) In a series of patients, coroniodectomy successfully accomplished immediate release of the mandible with no further difficulty.

Edentulous Upper Jaws: These present a problem in fixation. Slight displacement of the upper jaw is unimportant and merely calls for a new denture. In fractures of the bones of the middle third of

Fig. 12.—Roentgenogram of Hullihen splint applied with prong to proximal fragment of fracture of mandible.

the face an upper vulcanite plate is made and wired to the upper jaw, and treatment then proceeds as though a full complement of teeth were present (Fig. 7).

For backward and upward displacement with considerable impaction, overhead traction attached to the maxilla may be necessary for reduction. Weight traction, when required, is accomplished by threading a wire through the alveolus and attaching this to a cord passing over two pulleys of a balkan frame. The direction of pull can be altered by sliding the pulley along the beam of the frame. This will permit the patient to sit up or lie down, as may be necessary for comfort and rest. If the fracture is mobile, 1 to 2 pounds of weight will be necessary; late fractures will require up to 6 pounds, depending upon the degree of consolidation prior to traction.

Fractures of the Mandible.— As with maxillary fractures prior to reduction, all infected teeth require extraction, and even those in the line of fracture are pathways for the spread of infection. Nevertheless, teeth in the fracture line are sometimes maintained temporarily, when it seems probable that they may be valuable in reduction, and extracted later. Particularly with fracture through the molar region and angle, teeth may be indispensable in holding down the posterior fragment (Fig. 8, *A* and *B*). It is important also that salvageable teeth be retained for use in potential fixation. Close observation is essential, however, so that any tooth that produces an acute flare-up of infection may be immediately removed.

In fractures behind the last molar tooth, the main fragment is placed in normal occlusion and splinted to the maxilla, and the posterior fragment is immobilized as indicated by the direction and position of the fracture. If teeth are absent in the maxilla, the upper denture may be used to fix the lower jaw to the upper.

Comminuted fractures are cared for by immobilization of the main fragments in occlusion, the small fragments being permitted to align themselves in proper

position.

Fractures with loss of substance are immobilized by approximation of the fragments if the loss is 1 cm. or less; if it is over 1 cm. they are immobilized in their occlusal position to await a bone graft. This is an arbitrary measurement, and a nicety of judgment is necessary to determine which fractures can be cared for with and which without an autogenous graft.

Delayed union may be caused by many factors, such as infection of the fragments, tumor or insufficient immobilization. Removal of the cause and proper fixation will usually result in union. Nonunion, according to Lacey,[13] is usually due to loss of substance or eburnation of the fractured ends. If it is caused by loss of substance, the fragments should be immobilized until infection has disappeared and a bone graft has been inserted. If eburnation of the fractured ends is the cause, freshening of the ends and proper immobilization will usually be sufficient. Malunion may be cared for by grinding the teeth or by extraction (with refracture indicated in cases of gross deformity) and immobilizing the fracture in normal occlusion. If the maxilla is not fractured and teeth are present therein, it forms a most useful splint for fractures of the mandible.

In a comminuted fracture, each fragment is a potential center of osteoid tissue formation; therefore, no fragment should be removed that has a chance of viability. Only those pieces which are completely detached should be removed. Foreign bodies of any description between fragments may produce either delayed union or nonunion and must be removed. In soft tissues they are less harmful; the tissues will tolerate small fragments, if metallic. Removal of glass, ground-in dirt and foreign bodies, as well as general aseptic care, must be provided to meet the needs of each patient and the circumstances surrounding the trauma.

When a fracture passes through the socket of a tooth that is involved in the fracture, death of the pulp tissues is presumed, and nonunion may result if the dead tooth is allowed to remain (See Fig. 8).

Alveolar Fracture: For fracture of the alveolar process of the lower jaw, if the fragment is not grossly displaced and the blood supply not in danger, reduction and fixation in the original position should be done in the same manner as previously described for fracture of the alveolar process of the upper jaw. If the blood supply is questionable, extirpation is the procedure to follow. When the alveolar fragment has been removed the mucous membrane should be sutured over the bone, if possible, to hasten healing and the wearing of dentures.

Fracture of the Condyle: In fractures of the condylar neck there may be no dis-

Fig. 13.—Immobilization of symphysis obtained by metal cap splints.

placement, and only rarely are forward and outward displacement encountered. Reduction and fixation of this fracture causes little concern as to the final action, except in children, in whom bone growth is involved, and because the head in the joint cavity is not essential to efficient mastication. Loss of function of the external pterygoid is compensated by the other muscles of mastication. According to Zemsky,[14] difficulty encountered in open reduction does not warrant opening of the joint. Union, if it does occur, is unimportant, because treatment is directed toward muscle compensation, and whether fibrous or bony, is of slight concern (Fig. 9*A* and *B*).

Treatment is directed toward normal occlusion, with fixation by intermaxillary wiring maintained for three to five weeks. Motion is usually started at the end of five or six days, and complete removal of the fixation is done at four weeks. Displacement of the condyle affects function but little, if at all.

In bilateral condylar fractures a typical displacement occurs in the main body. The last molar teeth act as a fulcrum, producing an open bite anteriorly. Union in this position presents a serious problem. Compounding in the neck of the condyle is rare, so one may anticipate early and rapid union. Reduction should be done early, and continuous observation is necessary to anticipate any displacement that may occur. The displacement, when present, is usually lateral. As soon as normal occlusion is effected, the traction is reduced to maintenance and close observation. When motion is allowed, which is usually at the end of seven to ten days, centric occlusion must be insisted upon without compromise.

If the fracture is seen after fourteen to twenty-one days, bite blocks, as suggested by Ivy and Curtis,[15] may be used in the molar region. For pulling the lower incisor region forward and upward, anesthesia

Fig. 14.—Roger Anderson external pin fixation, used to control fracture of an edentulous mandible.

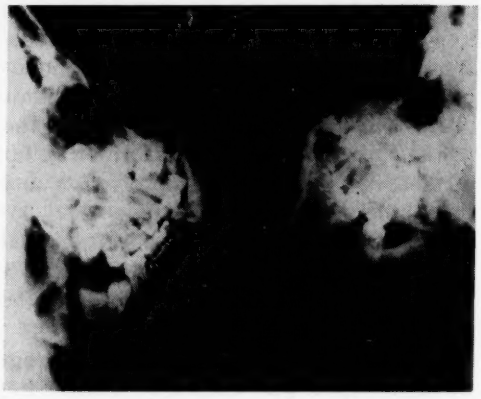

Fig. 15.—Molar tooth in molar region resisting displacement of posterior fragment.

may be necessary. If the fracture is seen after twenty-eight days, mechanical reduction is seldom if ever possible. Extraction of posterior molars may relieve the condition, but excision of the condylar heads must be considered.

Injury to the temporomandibular joint from the use of forceps at birth may result in a crushing injury to one or both con-

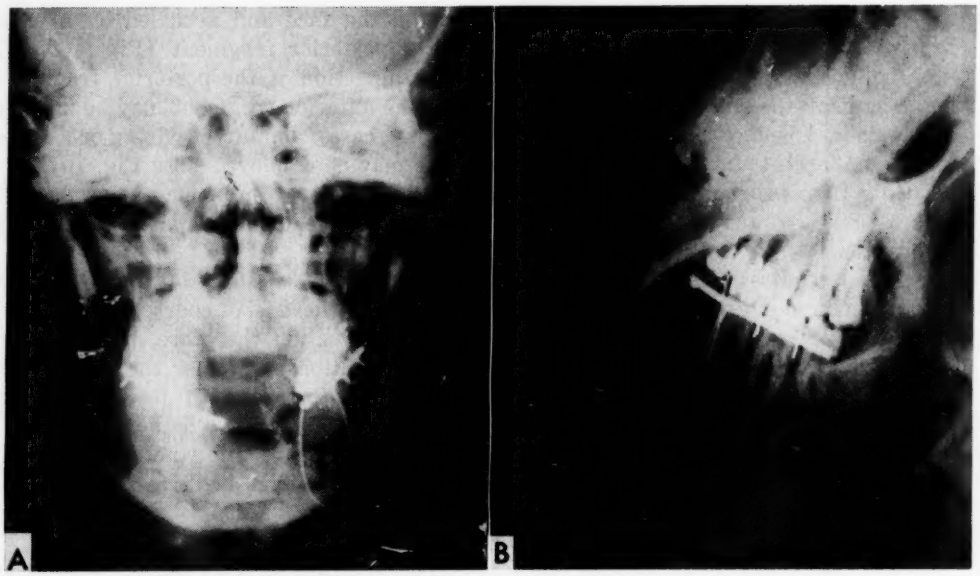

Fig. 16.—*A* and *B*, circumferential wiring used when teeth are either absent, too few or too insecure to afford attachment for wires, or when angle of fracture is such that circumferential wiring will hold proximal and distal fragments together.

dyles, according to Burket.[16] The prognosis is guarded when this accident occurs, because bony ankylosis nearly always follows, necessitating single or double condylectomy.

Fracture of the Coronoid: Fractures of the mandible in which the coronoid is separated from the ramus are infrequent. Reduction is rarely indicated, because, as a rule, there is little or no displacement of the body. The treatment is immobilization with intermaxillary wiring, with the teeth in occlusion, two to three weeks. If the mandible is edentulous, fixation is usually not indicated. It is only from compound fractures of the coronoid that trouble may be anticipated.

Fracture of the Ramus: The ramus of the mandible has strong muscle insertions on both sides, which usually prevent displacement and adequately control the edentulous fragment. The zygomatic arch is commonly associated with this particular fracture, and motion may be limited on healing (Fig. 9).

Treatment of fracture of the ramus *per se* is most easily accomplished by bringing the teeth into occlusion and maintaining fixation with intermaxillary wiring for two to three weeks.

Fracture at the Angle: Displacements encountered here are caused by the attachments of the elevator muscles, which pull the posterior fragment forward, upward and inward. The fragment describes an arc around the temporomandibular joint, if not resisted by the anterior fragment in the line of fracture. Viewed from above, the angle of the line of fracture may be such as to preclude inward displacement (See Fig. 8). Fracture at the angle may present a combination of circumstances whereby it is prevented from inward displacement but can be displaced forward and outward. In comminuted fractures the anterior fragment will have no control of

the posterior fragment.

Forward and upward displacement will be limited by the teeth present in the posterior fragment, the maxilla and the upper buccal sulcus. Displacement of this fragment is important in outlining proper treatment. Displacement of the anterior fragment is downward and rotated to the injured side.

Treatment requires nicety of judgment, and consideration is given to the following general principles: when function, union and appearance are not involved, reduction need not be attempted; if function and prosthetic appliances are hazarded, reduction is necessary, and when appearance is the only reason involved, reduction becomes a question of judgment. A large number of fractures of the angle require only fixation of the anterior fragment in normal occlusion, with use of the soft tissues to hold the posterior fragment in alignment.

If forward displacement results in pressure on the last upper molar, this tooth is left in place until union is complete, then extracted to relieve the irritation to the mucous membrane and the painful bite (Fig. 10). If the posterior molars are absent, a saddle attached to a splint extending from the anterior fragment may be used for control of the posterior fragment, but not for reduction. Ivy and Curtis, as has been mentioned, recommend the use of a block to reduce and hold the fragment when it is edentulous. Lenormant and Darcissac[17] suggested that this fragment be held by a wire attached to the posterior fragment and fixed to a plaster cap with a hook, as described by Scogin,[18] to supply traction. The method has the disadvantage of the head cap, which rotates after a few days and releases the tension, thus permitting the fragment to become displaced. This principle has been modified by Fry, Shepherd, McCleod, and Parfitt,[19] to the use of metal cap splints (Fig. 11) fastened to the anterior teeth with an arm posteriorly around the face and attached by a wire to the posterior fragment (Figs. 12 and 13). Impaction of the posterior fragment into the anterior fragment may be used in selected cases, and direct wiring or a Lane plate may be employed (See Fig. 10).

Roger Anderson pins may be used, with the advantage of immediate mobility of the jaw.

The Edentulous Mandible: If the jaw is edentulous, there is, of course, no occlusion to lose. Reduction, therefore, depends upon three conditions: whether the fracture is going to interfere with possible future prosthetic appliances; whether a facial deformity will result, and whether there will be a delay in union. Such fractures are usually simple, and union is generally rapid (Fig. 14).

The principle of reduction is the same as that involved in fractures when teeth are present. Many of these fractures will unite in good position by the application of a simple bandage. Nevertheless, one should never be lulled into treating all edentulous jaws in this manner.

The Gunning[20] interdental splint is useful for fixation, or the patient's own dentures, wired together, make an effective splint. These can also be used with circumferential wiring around the dentures when there is marked displacement.

Fracture in the Molar Region: Fractures here are influenced by the presence or absence of teeth on the posterior fragment, and also by the obliquity of the line of fracture. When this line runs from above downward and backward, displacement is more likely to occur than when it runs from above downward and forward. The elevator muscles are less able to displace the fragment in an upward direction if the fracture line is down and forward (Fig. 15).

If a tooth is present, this will tend to resist and even to prevent displacement. When the line is downward and back, with

no teeth present, the posterior fragment is displaced upward by the elevators and forward and inward by the rotators; the anterior fragment is depressed, and the midline of the mandible is diverted to the injured side. It is for this reason that the tooth in the posterior fragment is preserved, even though it may be in the line of fracture. A practical method of immobilization here is a modification of the technic of Lenormant and Darcissac, as previously credited to Fry and his co-workers. If bone loss is present, displacement forward is greater, and advantage may be taken of this to facilitate union, movement forward being prevented to the extent that contact is lost with the anterior fragment.

Fracture of the Body of the Mandible: If a sufficient number of teeth are present in the mandible and maxilla, they are held in occlusion with intermaxillary wiring. Displacement is slight, owing to action of the teeth, but if teeth are scarce and the injury severe great deformity occurs, depending on the line of fracture. When the fracture is vertical, the posterior fragment is displaced upward and the anterior fragment downward by the depressor muscles attached. The line of fracture is usually oblique, and the overlapping fragments tend to accentuate the displacement owing to the action of the external pterygoids.

If multiple fractures occur in the body, a typical deformity results. The middle fragment is generally displaced downward and backward and the two side fragments upward and toward the midline. The amount of displacement depends upon the obliquity of the lines of fracture. The backward displacement of the middle fragment may seriously interfere with respiration, and, owing to loss of control of the tongue, swallowing becomes difficult and the patient is unable to control the saliva, with resultant dribbling. Treatment may be accomplished by circumferential wiring,

Fig. 17.—Comminuted fracture of body of mandible held in occlusion by intermaxillary wiring and buccal arch bar.

intermaxillary wiring, the use of buccal arch bars or other methods as indicated (Figs. 16 and 17).

Fracture of the Symphysis: This fracture may be single, multiple, or comminuted. Single fractures are, as a rule, vertical, lying either between the central and lateral incisors or the lateral incisor and the canine, and there is little displacement of the fragments (Fig. 18). Intermaxillary wiring is usually adequate for immobilization.

Multiple fractures with teeth present, if seen early, may also be immobilized by intermaxillary wiring. If the jaw is edentulous, circumferential wiring may be used over a splint or a denture. The Kirschner type wire technic, previously mentioned, is also ideally adaptable to these fractures.

Comminuted fractures of the symphysis, when seen early, can be maintained in position by connecting the lower jaw to the upper with a buccal arch bar (Fig. 19). When seen late, this type of fracture is reduced by means of separate arch bars

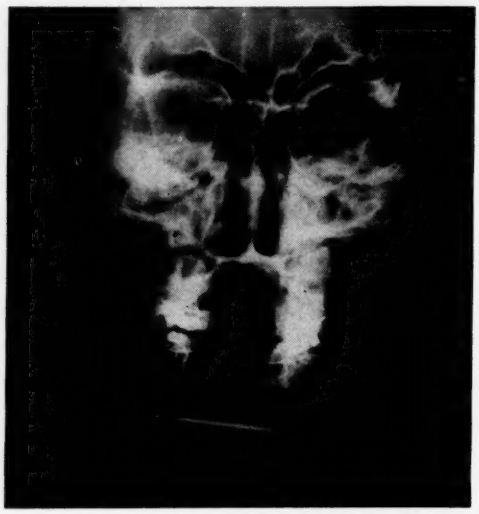

Fig. 18.—Compound comminuted fracture of symphysis immobilized with Kirschner wire, with internal fixation and multiple loop intermaxillary elastic traction. Lane plate holding posterior fragment.

applied to each mandibular fragment, the anterior ends left sufficiently long to overlap and bent to form a hook. A rubber band is stretched between the hooked ends, which exert force on the fragments away from the median line. When reduction has been accomplished, immobilization is obtained by intermaxillary wiring or cap splints. When no loss of bone is present the muscle groups are balanced and no deformity results, but if there is comminution the two main fragments are inverted and drawn toward the midline.

Period of Fixation. — An arbitrary period of thirty-five days is an average time limit for fixation of the uncomplicated fracture. This period varies from twenty-seven to forty-nine days and may differ with each patient. Young patients are held in fixation, as a rule, for a shorter period than are older ones. The basis of removal of fixation has been sufficient callus to maintain position when, on grasping the symphysis and the angle, spring in the fracture is absent, and also when function produces no noticeable movement by the patient. Roentgenograms seem to be of little or no help in determining the achievement of union, clinical union being present before it is demonstrable in the roentgenogram.

Fractures complicated by comminution, without infection and loss of substance, as well as bilateral and multiple fractures, require approximately the same period of fixation; those with infection, indefinite and varying periods.

Fig. 19.—Gunshot wound; loss of symphysis, lower lip and chin. Comminuted fracture of symphysis maintained in position by acrylic splint.

In uncomplicated fractures, limitation of motion on removal of fixation disappears usually within seven to ten days on normal use of the mandible. On resumption of chewing, talking and exercise, normal function is rapidly restored except in cases of extensive gunshot injuries in the region of the ramus, when limitation of motion may result from the formation of cicatrices, true joint ankylosis being rare.

COMMENT

For fractures of the upper and lower jaws in children and infants, interdental wiring may be done with a light wire. Owing to the shape and instability of the teeth in these patients, however, this wiring is usually difficult to control, and the application of a Roger Anderson splint or some form of dental splint cemented to the teeth will usually hold the fracture much better without jeopardizing the teeth of these youngsters. Fractures in infants are infrequent.

Many procedures, e.g., the application of wires, are better performed without anesthesia. Anesthetics are indicated, however, for operations upon the fracture areas when force may be applied. Local anesthesia is not used in the reduction of facial fractures if the surgeon is thereby hindered in the performance of the operation. Intravenous and rectal anesthetic agents are also avoided. Inhalation endotracheal induction is the simplest method, since the equipment used for it is the least complicated and by its use an adequate airway is maintained. The endotracheal tube, with complete occlusion of the pharynx, represents the maximum of safety for the patient and convenience for the surgeon. It enables the anesthetist and his apparatus to be well away from the field of operation.

In the repair of mandibular fractures particularly, general anesthesia is avoided whenever possible, especially when the upper and lower jaws are to be wired together. This is because postanesthetic vomiting may cause asphyxia during recovery from anesthesia and is likely to loosen or break the wires. For this reason and because of the strain placed upon the fixation and the teeth during the waking period, block or infiltration anesthesia is preferred and has been found sufficient in most mandibular fractures. When a general anesthetic is employed, the wiring is performed during the period of anesthesia. For repair of fractures of the zygomaticus, general anesthesia is the rule.

In operations upon the jaws, a short McGill tube is passed through the nose until the patient is completely awake, to insure an adequate postoperative airway. As an added precaution the patient is turned on the side or abdomen, with the head turned, in order that any drainage may run from the mouth by gravity, rather than depend upon suction to clear the throat of any blood or debris.

During the treatment of jaw fractures it is not necessary to remove the teeth in order to feed the patient. Many patients already have one or more teeth missing, or there is usually some space behind the last molars. The use of the stomach tube passed through the nose would be preferable to the removal of sound front teeth, but this is seldom necessary except temporarily and in cases of extremely severe injury.

It is essential that a patient with a fractured jaw or jaws receives sufficient caloric intake to maintain his weight and physical strength. He should be able to assimilate foods similar to those consumed prior to the accident, by pregrinding and massaging between the teeth. A well-balanced diet should be given and the patient encouraged to eat. Vitamins, when indicated, may be given for supplementation.

In the therapy of fractures, antibiotics and the sulfonamides are used only when indicated, e.g., for elevation of temperature and signs of infection.

One phenomenon observed by those who treat fractures of the jaws, is the fact that roentgenographic evidence of the formation of radiopaque callus does not occur for many months. Therefore, a fracture which on clinical examination is completely united, may appear on a roentgenogram to be ununited. It should be pointed out, accordingly, that we cannot definitely depend upon the roentgenogram for evidence of positive bony union.

SUMMARY

Fractures of the upper and lower jaws are discussed from the standpoint of immobilization, reduction and fixation of the bony tissues.

Methods of reduction are presented, and various appliances currently used for fixation are listed. The technic of application of these devices for each common site of maxillary and mandibular fracture is described.

It is emphasized that early immobilization, reduction and fixation of fractures of the jaws is a primary factor in obtaining satisfactory occlusion, bony union and restoration of the anatomic, functional and cosmetic status.

ZUSAMMENFASSUNG

Brüche des Ober- und Unterkiefers werden vom Standpunkt der Ruhigstellung, der Einrichtung und der Fixierung der Knochengebilde erörtert.

Es werden Methoden der Einrichtung der Brüche beschrieben und verschiedene Apparate aufgezählt, die zurzeit zur Fixierung benützt werden. Die Technik der Anwendung dieser Apparate für die verschiedenen häufig vorkommenden Lokalisationen der Ober- und Unterkieferbrüche wird beschrieben.

Es wird hervorgehoben, dass frühzeitige Ruhigstellung, Einrichtung und Fixierung der Kieferbrüche von primärer Bedeutung zur Erfielung einer befriedigenden Schlussbissstellung, knöcherner Heilung und günstiger anatomischer, funktioneller und kosmetischer Resultate sind.

RESUMEN

Las fracturas de los maxilares superiores e inferior se discuten desde el punto de vista de la immovilización, reducción y fijación de los tejidos óseos.

Se presentan métodos de reducción y varios artefactos usados para fijación se enumeran. Se describen las técnicas para aplicar estos artefactos para cada sitio común de fracturas de los maxilares.

Se enfatiza que la temprana inmovilización, reducción y fijación de las fracturas de los maxilares es un factor primordial para obtener oclusión satisfactoria, unión ósea y restauración del estado anatómico, functional y estético.

RIASSUNTO

Vengono discusse le fratture del mascellare superiore ed inferiodal punto di vista della immobilizzazione, riduzione e fissazione del tessuto osseo, presentati i metodi di riduzione e menzionate le tecniche correntemente usate per la fissazione. E' descritta inoltre la tecnica di applicazione delle protesi per ogni tipo di frattura.

Si sottolinea, infine, come il fattore più importante per ottenre una soddisfacente occlusione, il saldamento delle ossa e il ripristino dello stato funzionale, anatomico ed estetico sia la precoce immobilizzazione, riduzione e fissazione delle fratture del mascellare.

RÉSUMÉ

L'auteur discute de l'immobilisation, de la réduction et de la fixation des tissus osseux dans les fractures des maxillaires inférieurs et supérieurs. Il présente des méthodes de réduction, et énumère différents appareils de fixation d'usage courant dont il décrit la technique d'application.

Il Insiste sur le fait que l'immobilisation, la réduction et la fixation précoces sont des facteurs primordiaux pour l'obtention d'une bonne occlusion et de résultats anatomiques, fonctionnels et cosmétiques satisfaisants.

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Repair of Extensive Defects of the Scalp and Skull with Autogenous Tissues

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OWING to improved neurosurgical care after injury to the head, more patients are surviving severe and mutilating trauma to the cranial vault and soft tissues. Resection of tumors of the skull and radical excision of the cranial bones for chronic osteomyelitis also produce extensive voids. In addition, as the result of intensive radiation therapy and radical surgical ablation of recurrent carcinoma, large defects of the cranium and its coverings are often produced.

It is well known that a bony defect of the skull shows little or no tendency to spontaneous repair except in young children and then only after a portion of it has been removed for osteomyelitis or for craniosynostosis.

Analyzing our results with a large series of autogenous bone and cartilage grafts to the head and face, we have been impressed with the permanence of autogenous bone and cartilage transplants in contrast to the variance in absorption of homologous grafts, and with the increase in complications (infection, the collection of serum, foreign body and occasional extrusion, discomfort on exposure to heat or cold) following the use of foreign substances. In World War I, silver and lead had been used only to be condemned. Gold and platinum also were used but they proved too expensive and often were not well tolerated. Celluloid was also used but produced severe foreign body reactions.

As a result of these poor follow-up results at the beginning of World War II, surgeons were in general agreement that only autogenous bone obtained from the outer table of the skull, rib or ilium was reliable for the reconstruction of cranial defects. In spite of this, the use of tantalum by Pudenz and Odom[1] in 1942 was picked up with great enthusiasm. It became the popular method of cranioplasty, only to be challenged by the later use of plastic substances (acrylic and polyethylene).

At first few complications were reported. Again time was needed to assay the results. Elkin and Holbrook[2] reported complications in 12.3 per cent of 130 cranioplasties with tantalum plate and in 10 per cent of 66 cranioplasties with lucite. In 1947, Lane and Webster[3] observed that, of 115 tantalum plates inserted for the Veterans Administration, 52 had been removed. Scott and Wycis[4] reported a failure rate of 18 per cent when stainless steel was used for cranioplasty. In contrast to the aforementioned late results, Delageniere[5] in 1915 reported 104 cases of tibial osteoperiosteal grafts to defects of the skull with only 2 failures. Grant and Norcross[6] reported only 3 unsatisfactory results (5.1 per cent) in 58 cases of autogenous bone grafts to the cranium. Woolf and Walker,[7] in a collective review of cranioplasty, concluded that defects up to 8 cm. in diameter may be repaired with bone but that alloplastic substances are desirable for larger defects.

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Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.

Submitted for publication Jan. 10, 1956.

Fig. 1.—*A*, extensive defect of frontal region following radical resection of frontal bone for chronic osteomyelitis thirty years earlier. In recent years preserved cartilage has been inserted on several occasions, only to become absorbed. *B*, patient one year after reconstruction with autogenous bone graft.

In recent years we have encountered a series of cases of extensive defects of the scalp and cranium.

REPORT OF CASES

CASE 1.—H. P., a 50-year-old man, illustrates the absorption of preserved cartilage graft and later permanent correction with autogenous iliac bone. Thirty years ago this patient underwent a radical resection of the frontal bone for osteomyelitis. On several occasions thereafter preserved cartilage was inserted, only to become absorbed. A severe paresthesia developed along the distribution of the right supratrochlear nerve, with a trigger area in the scar. Figure 1*A* shows the extensive irregular defect in the area of the frontal sinus. The defect was exposed through a coronal incision and all of the scar was removed. A block of iliac bone was then removed and carved to fit into the defect, reconstructing the entire forehead and glabellar area. Figure 2 shows the same patient one year after the reconstruction. The paresthesia has been completely relieved.

CASE 2.—T. C., a 6-year-old boy, was struck by a steam roller, which caused a crushing injury to the left frontal and temporal regions and the middle third of the face (Fig. 2*A*). Pneumatocele developed after the original injury, and the reconstruction work had to be delayed. A left dacryocystorrhinostomy was first performed, followed by reconstruction of the floor of the right orbit and middle third of the face with autogenous cartilage (Fig. 2*B*). Moulages made in succeeding years indicate the continuous growth of the grafts over a period of four years (Fig. 2*C*).*

CASE 3.—The case of A. R., a 33-year-old man, illustrates correction of multiple defects with autogenous cartilage grafts. A. R. had sustained a crushing defect of the left side of the forehead and the left temporal and orbital regions, with depression of the malar

*Other cases in which autogenous bone and cartilage were used, followed for six to eight years, have revealed evidence of continuous growth of the grafts as long as the curve of motion of growth was in the ascend.

bone and the infraorbital plate. Nothing was done to elevate the malar bone, and six months later we were asked to correct the defects. This was done with carved autogenous cartilage implants and the ptosis of the left eyelid was corrected with the Blaskovics procedure. Figure 3*B* shows the degree of improvement attained but also illustrates the tendency

Fig. 2.—*A*, defect secondary to crushing injury of right frontal and temporal areas and middle third of face. *B*, patient after left dacrocystorhinostomy to correct blockage of nasolacrimal duct. Cartilage has been implanted to elevate right orbital floor and to correct retrusion of middle third of face. *C*, patient four years after correction of defect with autogenous cartilage graft.

Fig. 3.—*A*, deformity of left orbital, temporal and frontal areas resulting from severe depressed fracture of skull. *B*, reconstruction of bony deformity with autogenous cartilage, which shows slight tendency to curl. Diplopia has been corrected with cartilage graft to elevate orbital floor, and ptosis of eyelid by Blaskovics procedure.

Fig. 4.—*A*, irradiation sclerosis with recurrent carcinoma of forehead and supra-orbital area. *B*, patient several years after radical block excision involving area of outer plate of frontal bone and left supraorbital ridge. Reconstruction obtained by use of Italian flap.

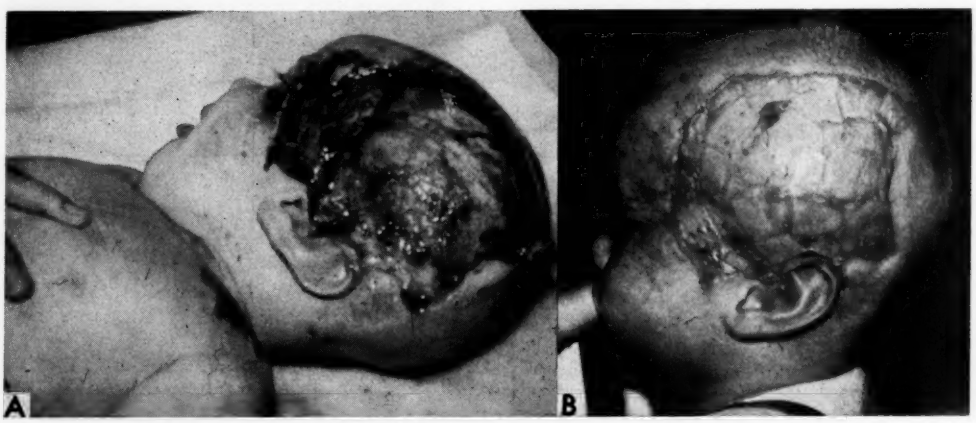

Fig. 5.—*A*, child three weeks after total destruction of 40 per cent of skull and its coverings. *B*, child at 2 years of age, after infection had been cleared and area healed with postage-stamp grafts

of autogenous grafts to curl.

CASE 4.—The case of M. K., a 48-year-old woman, illustrates that in certain instances reconstruction can be accomplished by the contouring of soft tissue alone. Seven years earlier M. K. had been given intensive roentgen therapy of the left side of the forehead for basal cell carcinoma, after which an exten-

sive area of roentgen dermatitis, telangiectasia and alopecia developed (Fig. 4*A*). Recently chronic ulceration had occurred in the region of the eyebrow. Owing to the recurrence of malignant disease extending along the pericranium and involving the supraorbital ridge, a radical block resection of the entire area, with radical removal of the outer table of the skull and the supraorbital ridge, was required to extirpate the lesion completely. The defect was then reconstructed with an Italian arm flap. Figure 4*B* reveals the final reconstruction. No bone was required in this instance to obtain an excellent functional and cosmetic result.

CASE 5.—Several years ago, we were called in consultation to see D. O., a 2-year-old child (Fig. 5*A*) who had survived total destruction of 40 per cent of the skull and its coverings, exposing the coverings of the left cerebral and cerebellar hemispheres in the anterior, middle and posterior fossae. The child seemed alert, and after the surface infection had been brought under control, the granulating surface was covered with postage stamp grafts (Fig. 5*B*). There was an excellent "take," and soon the entire surface was epithelized. The child was provided with a football helmet, which likewise presented its problems. It was decided, therefore, to mobilize the scalp from the intact side as a flap (Fig. 6*A*) and later to rotate this over the defect after having excised the previously grafted area. The exposed pericranium on the right was then reconstructed with deep intermediate grafts removed from the abdomen. After this had been healed for months and there was no recurring infection, it was decided to repair the skull defect. Dr. Edgar Lotspeich, the neurosurgeon, and the authors decided to work as a team.

As a result of analyzing our results with 146 autogenous bone and cartilaginous grafts to the head and face, we were impressed with the permanence of the autogenous osseous transplant and the manner in which it would stand up under reactivated infection. In addition, we had direct evidence in measurements and moulages of the continued growth of these grafts in young patients observed during the growing period for six to eight years. Since the defect in the skull now measured 14 cm., having increased 1.5 cm. in diameter during the past year, it was felt that four full-length rib grafts, taken in four separate operations and then split, would provide sufficient autogenous bone. This was carried out

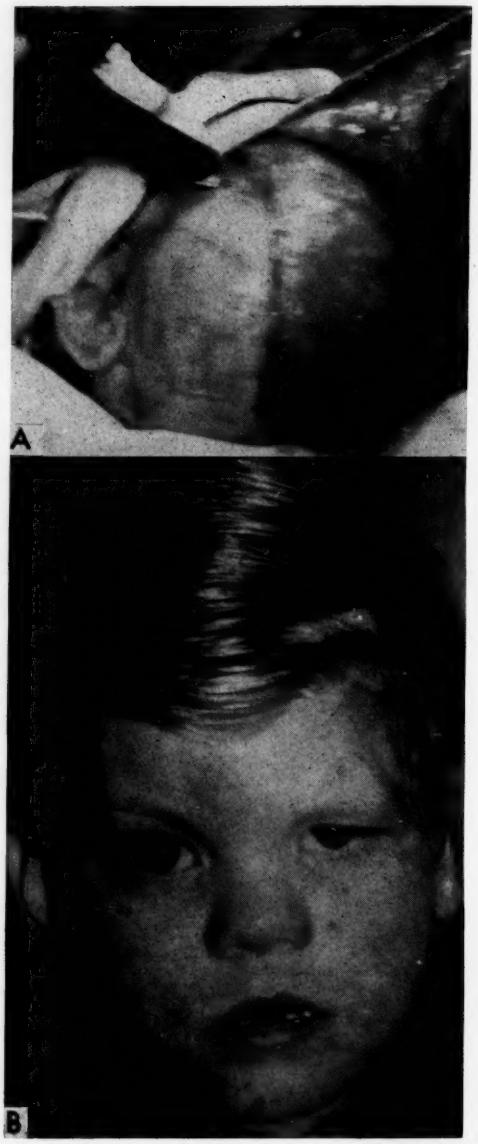

Fig. 6.—*A*, flap mobilized from normal side of scalp. *B*, patient two and one-half years after completion of reconstruction (skull and overlying scalp).

in stages, and even though after two operations there was some purulent drainage from the cerebral wounds, they healed without the extrusion of a single fragment of bone. In-

stead, within a year there was definite roentgen evidence of osteogenesis extending from the edges of the skull defect to the rib grafts and between the grafts themselves. The rib grafts were removed first from the left side of the chest and then from the right. On subsequent removal of the third and fourth grafts, the resected rib had regenerated so that it was difficult to tell it from its normal neighbor. Clinically, at the time of writing, the large defect is reconstructed with solid bone. It is not sensitive, nor is there any evidence of fluid or edema. The child (Fig. 6*B*) has not worn any protective dressing since one month after the last bone graft was inserted. He speaks and plays normally with his brothers and sisters.

SUMMARY

The authors present their experience with a large series of cases in which autogenous bone and cartilage grafts were employed in the treatment of extensive defects of the scalp and skull. They are impressed with the lasting qualities of such material in contrast to those of homologous grafts. Five illustrative cases are reported.

RESUMEN

Los autores presentán su experiencia con una gran serie de casos en los cuales se emplearon injertos autógenos de hueso y cartílago en el tratamiento de extensos defectos del cráneo. Ellos estan impresionados con las cualidades duraderas de ese material en contraste con las de los injertos homólogos. Se reportan cinco casos ilustrativos.

ZUSAMMENFASSUNG

Die Verfasser berichten über ihre Erfahrungen mit körpereigenen Knochen- und Knorpeltransplantaten in der Behandlung einer langen Reihe von Fällen mit umfangreichen Defekten der Kopfhaut und des knöchernen Schädels. Sie sind von den dauerhaften guten Eigenschaften dieses Materials im Gegensatz zu denen homologer Transplantate beeindruckt. Sie berichten über fünf erläuternde Krankheitsfälle.

RÉSUMÉ

Les auteurs présentent le résultat de leur expérience en s'appuyant sur une grande série de cas dans lesquels ils ont utilisé des greffes d'os et de cartilage autogènes pour le traitement de lésions étendues du cuir chevelu et du crâne. Ils ont été impressionnés par les qualités durables d'un matériel comparé aux greffes homologues. Cinq cas typiques sont rapportés.

RIASSUNTO

Gli autori comunicano la loro esperienza zu trapianti autogeni di osso e di cartilagine, che essi hanno utilizzato in un gran numero di casi per riparare vaste perdite di sostanza del cranio e del cuoio capelluto. La loro impressione è che questi materiali abbiano qualità superiori, a quelli omologhi.

Riferiscono 5 casi dimostrativi.

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The Thigh Lift

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IT has been said that the plastic surgeon is the greatest of contemporary artists, for he paints on living canvas and carves sculpture in human flesh. It is not only the patient with a facial defect or blemish who appreciates the efforts of the plastic surgeon, and it is with areas apart from the face that this article deals.

Today, increased knowledge of cardiovascular disease has led to the realization that obesity is a definite handicap to longevity. One sees increasing numbers of persons who have, under medical supervision, lost their excess weight. In those so fortunate as to have only a reasonable number of excess pounds to lose, the subcutaneous tissue and skin accommodate themselves and a degree of shrinkage occurs that does not reveal the degree of stretching formerly undergone by the skin. In excessively overweight persons, persons of advanced age or persons whose excessive weight has been present for years, the skin does not retain its elasticity and recuperative power. Even if the excessive weight is lost over a long period—one to two years—the skin still has not the degree of recovery that could be desired. With the present popularity of the trim figure and the reduction of the overweight, there will be more and more men and women who have relaxation of the skin and subcutaneous tissues not only of the face but about the body as well.

Procedures have been described for cutis laxa. These, for the most part, deal with the tightening and elevation of the redundant skin of the face and neck (meloplasty). Procedures have also been described for reduction of the overhanging pendulous abdomen (Fig. 1).

In some persons the redundancy of the skin is noticeable not only in the cheeks, neck and abdomen but in the breasts and thighs (Figs. 1, 2, 3 and 4). The procedure for management of redundant mammary skin in the male is similar to that for correction of redundancy in the female. If the redundancy is severe, it must be handled by complete excision of the redundant skin and transplantation of the nipple and the areola. A search of the literature, however, has revealed no satisfactory method of handling redundancy of the skin of the thigh.

With this problem in mind, a procedure was desired that would work no particular hardship on the patient, would preserve the circulation and could be carried out with a minimum of visible scarring and a maximum of possible benefit in appearance and comfort. Such a procedure, to fulfill the expected qualifications, should elevate the skin of the thigh and at the same time tighten the skin in a circumferential manner. Obviously, a complete circumferential incision about the thigh, with elevation of the skin and subcutaneous tissue, would best accomplish the elevation, whereas a long vertical incision down the thigh, with wide elliptic excision of skin and subcutaneous tissue, would accomplish only a tightening of the skin and subcutaneous tissue. The first part of this procedure has the disadvantage of interfering with the blood supply to the edge of the skin below the point of exci-

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Jan. 10, 1957.

sion of tissue, although this can be minimized to a great extent by avoiding any undercutting at the lower incision and by beveling the excision of tissue outward so that the skin has a good blood supply coming from beneath the subcutaneous tissue. The vertical incision could be placed in a posterior position and, therefore, be as little noticeable as possible, but it would certainly be slower to heal at the juncture of the longitudinal and transverse incisions, unless done in two stages.

With this in mind, a one-stage procedure was evolved that would result in a satisfactory degree of improvement, with less visible scarring than follows the procedures aforementioned, and could be performed in one stage with prompt healing of the wound edges (Fig. 5). The incision should start in the inguinal region, just below the anterior iliac spine; should traverse the inguinal region, cross the medial aspect of the thigh to the posteromedial aspect of the thigh high against the buttock, and then go down the posteromedial aspect of the thigh to a point just proximal to the knee (Fig. 5). The femoral vessels are avoided in the inguinal region, and the long saphenous vein may be severed or left intact as indicated. Elevation of the skin is accomplished (1) by excising tissue below this incision and pulling the skin upward to close it again in the inguinal region and (2) by excising a wide ellipse of skin and fatty tissue from the posteromedial aspect of the thigh and closing this incision at that most inconspicuous location. By excising a generous wedge of fatty tissue from beneath the ends of the incision below the anterior iliac spine and above the knee, it is possible to avoid extending the incision out into more noticeable areas to avoid puckering in these areas. It is recommended that the wound be closed in layers to prevent the development of a depressed scar and to give the best possible cosmetic re-

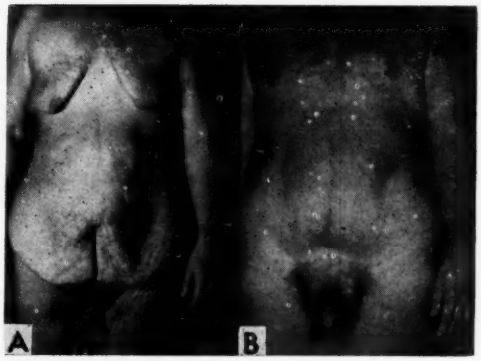

Fig. 1.—*A*, pronounced redundancy of tissue of breasts, abdomen and thighs after weight loss from 370 to 180 pounds (167.8 to 81.6 Kg.) in two years. *B*, appearance after surgical correction by mammaplasty, abdominoplasty and thigh lift.

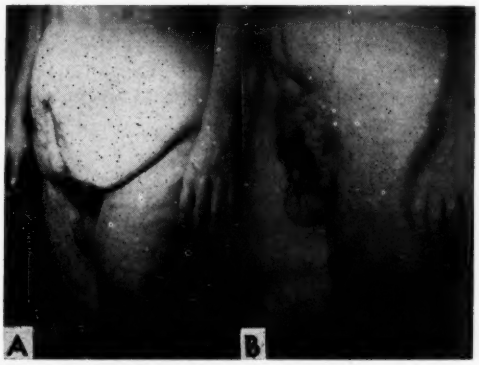

Fig. 2.—*A*, Side view of abdomen and upper parts of thighs after considerable loss of weight. *B*, appearance after surgical correction.

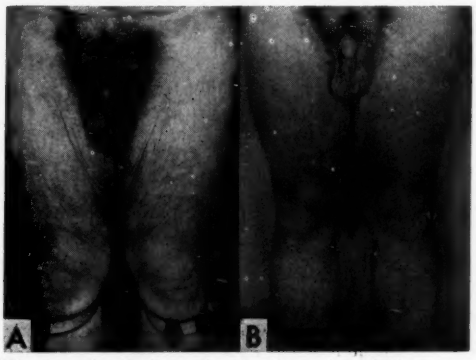

Fig. 3.—*A*, ptosis and redundancy of thighs even after abdominoplasty, which lifted thigh skin to some degree. *B*, appearance after thigh lift.

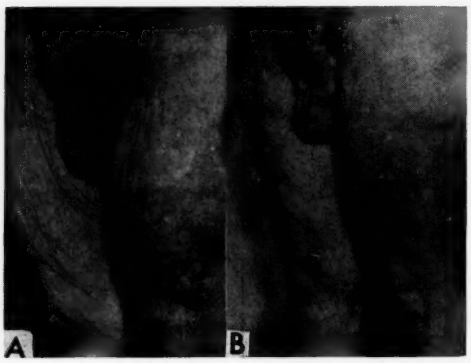

Fig. 4.—*A*, redundancy and relaxation of skin and subcutaneous tissue of thighs. There is obvious need for lifting and tightening tissue in both vertical and horizontal directions. *B*, improved appearance of thighs, accomplished with inconspicuous scars.

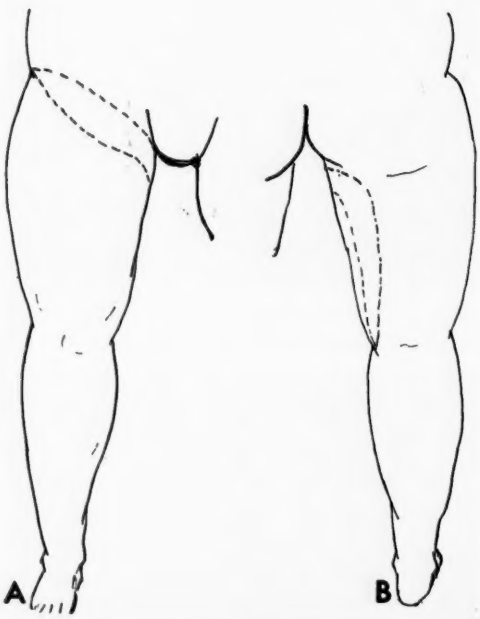

Fig. 5.—*A*, transverse elliptic excision is carried out so that resultant scar lies along inguinal crease. Tissue at lower incision should be beveled out to edge of skin to avoid embarrassing the circulation to the cutaneous edges. *B*, vertical excision lying along posteromedial aspect of thigh. This accomplishes tightening, while transverse excision accomplishes lifting.

sult. My own preference is for a doubled Type A white nylon suture in the subcutaneous tissue; a small bite of the dermis it taken to permit the main tension sutures to be tied subcutaneously, and single Type A white nylon sutures are used in layers in the fatty tissue and in the dermis between the spaced buried tension sutures. Skin sutures of No. 5-0 black silk or subcuticular No. 4-0 monofilament nylon sutures are used. A snug ace bandage is applied over the sterile dressing from the toes to the upper part of the thigh, and a snug pressure dressing is applied over the inguinal incision. The patient is kept in bed with the feet elevated for the first twenty-four hours, after which he may be up and about *ad libitum* with the elastic bandages in place. Elastic bandages or elastic stockings are desirable for two weeks, with supportive dressings on all the incisions as required. Postoperative pain is surprisingly mild.

SUMMARY

A technic for reduction of the redundancy of the skin and subcutaneous tissue of the thighs has been described to join the surgical armamentarium for reduction in the redundancy of skin and subcutaneous tissue of the abdomen, breasts, face and neck to improve the comfort and appearance of patients who have lost excessive weight. The author's limited experience with this operation, which was devised to solve a specific problem, has been satisfactory. He is convinced that in the future he can safely excise the skin and subcutaneous tissue more generously, thus obtaining a snugger closure and increasing the elevation of the ptosed and relaxed tissue. The comfort of the patient should not be overlooked, and convenience in the fitting of clothes is not a minor factor; the patient's self-confidence and improved psychic outlook after the operation, however, outweigh these other factors.

RÉSUMÉ

Une techniques de résection de l'excédent de peau et de tissus sous-cutanés des cuisse est décrite, s'ajoutant à celles en usage pour l'abdomen, les seins, la face et le cou, appliquées aux malades ayant subi une perte de poids importante. Son expérience quoique limitée de cette technique —conçue afin de résoudre un problème spécifique—a permis à l'auteur d'obtenir des résultats satisfaisants. Il est convaincu de pouvoir à l'avenir procéder sans danger à des excisions plus étendues, obtenant ainsi une cicatrice plus souple et augmentant l'élévation des tissus relâchés et ptosés. Le confort du malade ne devrait pas être négligé, et le port seyant de ses vêtements n'est pas un facteur mineur; cependant la confiance en soi retrouvée et l'état psychologique post-opératoire ont plus d'importance que ces autres facteurs.

RIASSUNTO

Viene descritta una tecnica per ridurre l'eccesso di cute alle anche; questa tecnica deve essere affiancata a quella in uso per ridurre la sovrabbondanza di cute e sottocutaneo dell'addome, delle mammelle, del viso e del collo, allo scopo di migliorare l'aspetto delle persone che abbiano avuto una forte perdita di peso.

L'esperienza dell'autore, benchè limitata, è stata soddisfacente; egli è persuaso che in avvenire si potranno escidere con sicurezza tratti molto più ampi di cute e di sottocutaneo così da ottenere una migliore sistemazione dei tessuti ptosici e rilassati.

RESUMEN

Se describe una técnica, para reducción de la piel y tejido celular subcutáneo redundantes en los muslos, para agregarse al armamentarium quirúrgico para la reducción de la piel y tejido celular subcutáneo redundantes en el abdomen, el pecho la cara y el cuello para mejorar la comodidad y la apariencia de pacientes que han perdido excesivo peso. La limitada experiencia del autor con esta operación que ha sido creada para resolver un problema específico ha sido satisfactoria. El está convencido de que en el futuro él puede extirpar sin riesgo piel y tejido celular subcutáneo mas generosamente, obteniendo así un cierre más ajustado y mejorando la elevación de los tejidos relajados y caidos. La comodidad del paciente no debe menospreciarse, y la conveniencia en el ajuste de la ropa no es de menor importancia; sin embargo, el factor más importante es el mejoramiento de la condición psicológica del paciente y su confianza en sí mismo después de la operación.

ZUSAMMENFASSUNG

Dem Chirurgen, der zur Besserung des Wohlbefindens und der äusseren Erscheinung von Kranken mit erheblichem Gewichtsverlust durch Entfernung überflüssiger Haut und überflüssigen Unterhautzellgewebes am Bauch, an den Brüsten, am Gesicht und am Hals beiträgt, wird durch die Beschreibung einer Technik zur Resektion überflüssigen Haut- und Unterhautgewebes am Oberschenkel eine weitere Möglichkeit auf diesem Felde geboten. Die begrenzten Erfahrungen des Verfassers mit dieser Operation, die mit dem Ziel der Lösung eines bestimmten Problems ausgearbeitet worden ist, sind zufriedenstellend. Er ist überzeugt, dass er in Zukunft ohne Gefahr umfangreichere Resektionen der Haut und des Unterhautzellgewebes ausführen und somit einen strafferen Verschluss und eine bessere Hebung des ptotischen und erschlafften Gewebes erzielen kann. Das Wohlbefinden des Kranken und die ihm gebotene Möglichkeit, in seine Kleider zu passen, sind

Faktoren, die nicht unterschätzt werden sollen, die jedoch weit in den Hintergrund treten gegenüber dem Selbstvertrauen und dem verbesserten Seelenzustand, dessen sich der Patient nach der Operation erfreut.

Intellectual passions are not like appetites; they do not reach out to grab, but set out to enrich the world. Yet such a move is also an attack. It raises a claim and makes a tremendous demand on other men; for it asks that its gift—its gift to humanity—be accepted by all. In order to be satisfied, our intellectual passions must find response. This universal intent creates a tension. We suffer when a vision of reality to which we have committed ourselves is contemptuously ignored by others. For a general unbelief threatens to evoke a similar response in us which would imperil our own convictions. Our vision must conquer or die.

—*Polyani*

It is clear that experiment involves an even higher degree of abstraction than simple observation, for many more facts out of the total presenting are put in the discard, and this is why, perhaps, the experimental method, exclusively pursued, may prove somewhat narrowing to the mind, adverse to a philosophic generality of outlook, and to the free play of ideas ranging over the sum of presenting phenomena.

—*Walshe*

Before we shall ever be able to answer the question, why or how do tumours form? it seems to me we must be able to solve the problem of normal growth and development and to answer the question why or how it is that these continue up to a certain point and then suddenly cease.

—*Savory*

Arterial Grafts

(Compressed Molded Ivalon Tubes)

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IN the past twelve years the treatment of segmental arterial diseases by resection and substitution of various types of grafts has been successfully accomplished by many surgeons. Arterial homografts have been used most often, but the difficulty in obtaining and preserving such grafts has led to a search for a more satisfactory substitute. Furthermore, the observed occurrence of late degenerative changes in homografts has led to speculation concerning their ultimate fate.[1]

It is generally asserted that an arterial homograft does not act as a true graft but merely serves as a blood-carrying conduit which is, to a certain extent, reinforced by the fibrous connective tissue of the host. Numerous studies[2] have shown that the intima, media and adventitia of arterial homografts persist as dead donor tissue, which undergoes gradual disintegration of cell nuclei, collagenous fibers and, finally, the elastic laminae. Although these histologic changes would suggest ultimate weakening of the wall, they are apparently offset by the adaptive reaction of the host. The inner lining of the homograft becomes covered by a smooth endothelium like layer of amorphous collagen and fibrin except at each end, where the intimal cells of the host grow out for a distance of 1 to 2 cm., with frequent irregular, finger-like extensions for variable distances. From the adjacent collagenous connective tissue of the host there is formed a fibrous tube surrounding the transplant. This connective tissue invades the interstices of the transplant, mingling with its original elements, and is vascularized both by luminal blood and by capillary tufts that accompany the fibrous connective tissue.

Recently, two human aortic homografts became available for study twenty-four and twenty-seven months, respectively, after transplantation. The two cases will be the subject of detailed report at a later date, but illustrate well the variation in the adaptive response described. In the first case, an aortic homograft removed six hours after the accidental death of a 35-year-old Negress and preserved in a nutrient electrolyte medium at 4 C. for fifty-five days was transplanted into the abdominal aorta of a 64-year-old man after resection of an arteriosclerotic aneurysm. The patient remained well until he was involved in a serious motor accident twenty-four months later, almost to the day. A laceration of the graft occurred, and a false aneurysm developed, necessitating operation, at which time a freeze-dried homograft was inserted. The patient

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Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.

Submitted for publication Sept. 21, 1956.

recovered uneventfully. Gross observation of this specimen revealed a laceration in the middle of the anterior surface of the graft. There was some definite aneurysmal dilatation. The graft was surrounded by a mildly adherent fibrous sheath and by a large hematoma.

Microscopically, fragmentation and degeneration were observed, and at the point of aneurysm formation the elastic laminae of the media had completely disappeared.

The second patient, a 60-year-old man, died of coronary thrombosis and asthma twenty-seven months after the insertion of a freeze-dried aortic homograft obtained from a 24-year-old soldier after accidental death. Examination of this specimen showed a functional graft well surrounded by a fibrous connective tissue sheath. The lining was smooth, and the anastomotic sites showed union of the connective tissue to the aorta and common iliac arteries of the host.

Microscopic study revealed a smooth intimal lining, with preservation of fibrous connective tissue and of the elastic laminae. There was some degeneration and fragmentation of the media.

In essence, only autogenous arterial transplants serve as true grafts. Homologous transplants do not survive, but merely remain as functional blood-carrying tubes, the micro-anatomic structure of which gradually degenerates and is reinforced by invasive and circumferential supporting fibrous connective tissue cells of the host.[3]

Since this is true, suitable synthetic prostheses should behave in a similar fashion. Currently there is widespread interest in attempts to produce an entirely acceptable synthetic arterial substitute. Most investigators[4] have used cloth tubes made from synthetic fibers, such as vinyon-N, nylon, dacron, orlon, teflon and the like. These materials have functioned reasonably well as arterial substitutes, but they have several disadvantages that make them less than ideal. They are technically difficult to implant; they may leak excessively, and they have a tendency to wrinkle and become thrombosed.

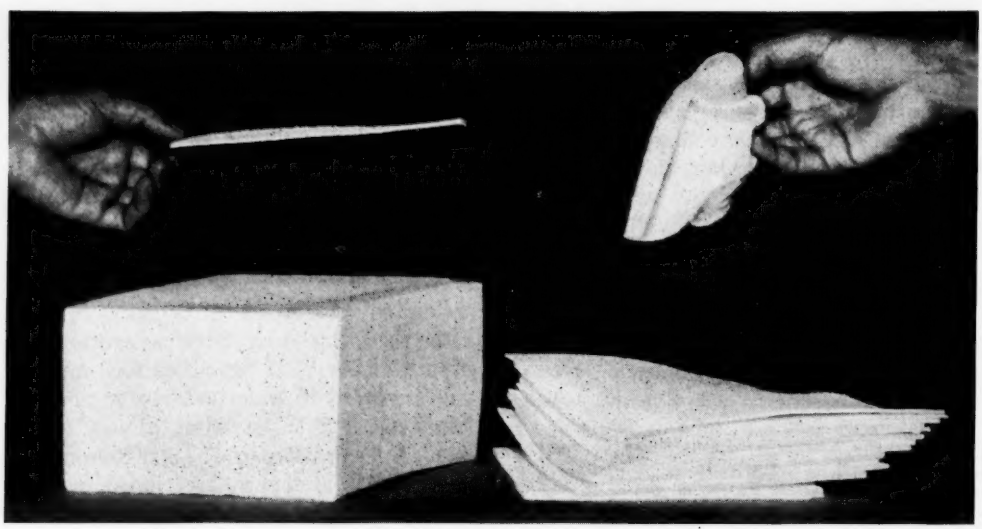

Fig. 1.—Ivalon block and slices.

Grindlay and his associates,[5] as early as 1951, reported on the properties and tissue response of formalinized polyvinyl alcohol sponge (Ivalon). Since then, Mortensen and Grindlay[6] and Shumway and his associates[7] have reported a favorable experience in the substitution for major arteries, both experimentally and clinically, of tubes made of molded compressed Ivalon sponge. Gross and histologic observations have revealed a fate for these materials similar to that of homografts.[6]

Using a method similar to that of Shumway, Gliedman and Lewis,[7] we have constructed Ivalon arterial prostheses, and on the basis of our experience with these in dogs and patients, consider them satisfactory arterial substitutes. In fact, we prefer them to homografts for replacement of arteries the size of the common femoral or larger.

Method of Construction of Ivalon Tubes.—The remarkable physiochemical properties of Ivalon must be known for the proper construction of arterial grafts. The material is supplied in block sponge form, which is soft and pliable and is kept so by a hygroscopic agent. Formaldehyde is also present to inhibit bacterial growth. This raw product must be washed thoroughly under running water for twenty-four hours, or a severe foreign body reaction will be evoked by the retained formaldehyde (Fig. 1).

After washing, the large block must dry thoroughly to allow cutting. Five days should be allowed for complete drying. By means of a large band saw, the block is cut into sheets varying from 1.5 to 3.5 mm. in thickness.

To form the graft, the sheets are soaked in cool tap water. They become flexible, elastic, spongy and hydrophilic.

Our compression molds are of stainless steel with brass cores (Fig. 2*A*). They are precision-machined to provide uniform luminal diameter and wall thickness.

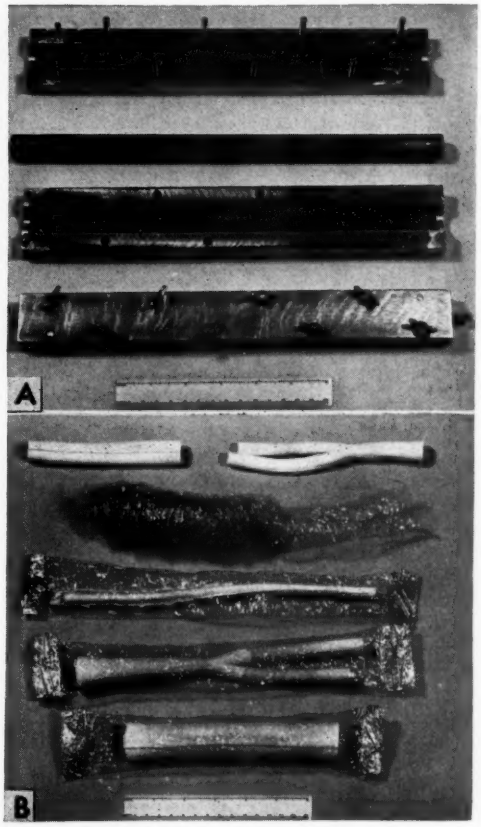

Fig. 2—*A*, stainless steel molds with brass core. *B*, method of storing finished molded grafts in sterile cellophane bags.

While moderately stretched, the wet sheets are rolled upon the brass core approximately three times, providing a wet, uncompressed thickness of 9 to 12 mm. The wet, spongy roll is compressed in the mold and autoclaved for twenty minutes. It is usually necessary to retighten the wing nuts once during this sterilization.

After compression to a final thickness of 1.5 to 2 mm., a sixfold increase in density is achieved. The mold is cooled; the graft is removed and trimmed and is ready for use.

In our opinion the final density is of the utmost importance in determining the

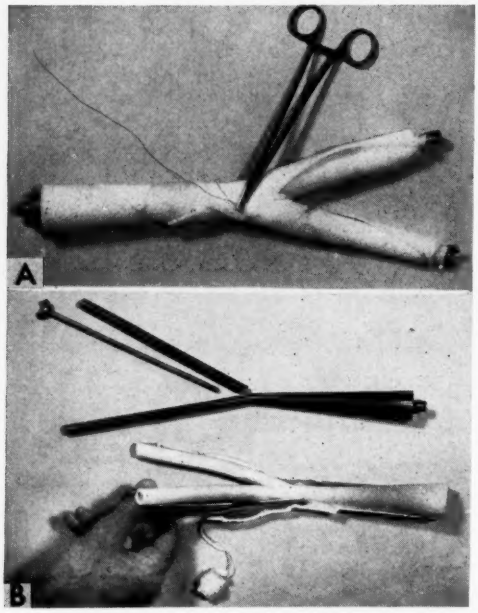

Fig. 3.—*A*, application of wet strips of Ivalon to bifurcation mold. *B*, removable leg of the bifurcation core.

properties necessary for the success of the finished graft.

Owing to lack of precision in several of the steps, the final test is still the clinical estimation by an observer experienced in constructing these grafts.

Sterile technic is achieved in any one of several ways. The graft can be used immediately, dropped into a sterile container to dry, re-autoclaved while dry in cellophane bags, or preserved in aqueous zephiran. If properly made, dried grafts reconstitute within twenty minutes in warm water (Fig. 2*B*).

A similar technic is used in the construction of a bifurcation graft. The special shape necessitates the tacking of the wet Ivalon strips with No. 5-0 silk (Fig. 3*A*). This is compressed and autoclaved in the manner described. Some facility must be available in order to remove the finished graft from its brass core. We use a removable "leg" to achieve this (Fig. 3*B*).

Again, we stress the fact that if this material is to yield a satisfactory graft it must be properly constructed. The minute technical details of this construction and the finer physiochemical properties of Ivalon, so important in the construction, are not pertinent to this discussion.

These Ivalon arterial substitutes closely resemble a normal artery. They are elastic and pliable in all directions and pulsate when carrying blood. They have a smooth, seamless internal surface, can be molded to fit the configuration of any vessel, are easy to suture to the host vessel and can be anastomosed to each other. They are durable and in fact become stronger as host tissue invasion progresses.[6] They are porous enough to permit proper invasion by vascularized fibrous tissue from the host and yet not so permeable as to permit excessive leakage of blood when first allowed to fill under arterial pressure.

Biologically, Ivalon seems to be inert, having no carcinogenic properties,[8] and does not induce significant inflammatory foreign body reactions when the grafts are properly constructed.

The ready availability and adaptability of Ivalon arterial tubes are additional attractive qualities. With regard to this, their chief disadvantage would seem to be the necessity for extreme attention to detail in proper methods of construction. In fact, despite earnest efforts, we find it difficult to construct Ivalon tubes of uniform porosity, pliability and density.

Ivalon blood vessels have been substituted for defects of the abdominal aorta of 22 dogs. Eighty per cent of these grafts have remained patent and functioned satisfactorily for as long as nine months, after which time the dogs were killed. Gross and microscopic observations of these transplants show: (1) the formation of a smooth fibrinous internal lining; (2) circumferential and invasive support

Fig. 4.—Ivalon graft at thirty-seven weeks in abdominal aorta of dog.

by vascularized fibrous connective tissue of the host; (3) preservation of integrity of the Ivalon scaffold itself, and (4) absence of any inflammatory reaction about properly prepared grafts (Fig. 4).

In 14 patients compressed Ivalon blood vessels have been substituted. All aortic and iliac grafts (10 cases) have functioned perfectly, whereas all femoropopliteal shunt grafts (4 cases) have become thrombosed.

We do not conclude from this, however, that Ivalon vessels are necessarily unsatisfactory for replacement of small blood vessels. The gross physical and histologic properties of Ivalon blood vessel substitutes are ideal for proper function. It is our conviction that failures of small blood vessel grafts in the lower extremity occur not as the result of properties inherent in the material used but are due rather to a hemodynamic factor.

Aortoiliac grafts, almost regardless of material or length, function and do not become thrombosed. In fact, severely diseased, atheromatous, ragged aortas infrequently reveal clinical thrombosis. This is perhaps due to the pressure and high velocity of the blood flow in these vessels. Although we have not yet had the opportunity to decide, our opinion is that shunt grafts used to correct arterial insufficiency to the lower extremity should be anastomosed to the anterior surface of the aorta or the common iliac arteries, in order to realize the advantage of proximal high pressure and high velocity flow. Furthermore, an adequate outflow system must be present in the femoropopliteal system if the graft is to remain patent.

SUMMARY AND CONCLUSIONS

Arterial reconstruction of large arteries by means of molded compressed Ivalon sponge has proved acceptable and satisfactory in experimental animals and patients. These synthetic arterial substitutes closely resemble arterial homografts in their response, both physically and biologically. They seem to be well tolerated in the human body and serve as functionally satisfactory arterial substitutes.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Der Wiederaufbau grosser Arterien mittels geformten komprimierten Ivalonschwammes hat sich sowohl im Tierversuch als auch beim Menschen als annehmbar und zufriedenstellend erwiesen. Das physiologische und biologische Verhalten dieses synthetischen Ersatzmaterials

ähnelt sehr dem des Arterientransplantats innerhalb der gleichen Art. Der menschliche Körper scheint das Material gut zu vertragen, und die funktionellen Leistungen der Ersatzstücke sind zufriedenstellend.

RESUMEN Y CONCLUSIONES

La reconstrucción arterial de grandes arterias por medio de esponja de Ivalon comprimida y moldeada ha demostrado ser aceptable y satisfactoria tanto en animales de experimentación como en pacientes humanos. Tanto el resultado fisiológico como el biológico con estos sustitutos sintéticos es muy semejante a los obtenidos con homoinjertos arteriales. Parecen ser bien tolerados por el cuerpo humano y sirven a satisfacción funcionalmente como sustitutos arteriales.

RIASSUNTO E CONCLUSIONI

La ricostruzione delle grandi arterie per mezzo dell'Ivalon in spugna modellata si è dimostrata soddisfacente così negli esperimenti come nelle applicazioni alla patologia umana. Vi è una stretta rassomiglianza fra le risposte fisiologiche e biologiche di questa sostanza con gli innesti omologhi. Essa è pertanto ben tollerata dall'organismo umano ed è soddisfacente dal punto di vista funzionale.

RÉSUMÉ ET CONCLUSIONS

La reconstruction synthétique des grandes artères s'est révélée pratiquable et même satisfaisante, aussi bien chez l'animal que chez l'homme. Les réactions physiologiques et biologiques des substituts artériels synthétiques ressemblent étroitement à celles des greffes artérielles homoeplastiques. Ils semblent être bien tolérés chez l'homme.

SUMÁRIO E CONCLUSOES

A reconstrução de grandes arterias pela esponja de Ivalon pre-moldada demonstrou resultados satisfatórios tanto em animais como em seres humanos. As respostas fisiologicas e biologicas a tais substitutos sintéticos se parecem com as dos homoenxertos arteriais. Parecem ser bem toleradas e funcionalmente se comportam como substitutos arteriais.

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"Minor" Injuries of the Fingers

J. WALLACE McNICHOL, M.D., F.R.C.S. (Can.), F.A.C.S., F.I.C.S.
AND
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THIS title was chosen to emphasize by paradox the fact that injuries which interfere with the function of the hand are not minor.

The field of traumatic surgery of the hand is vast and important, so we propose to discuss only one small facet, namely, to illustrate the potentialities and adaptability of the so-called cross-finger pedicle procedure in the treatment of loss of soft tissue of the digits.

Iselin in 1946, and many writers since, have stressed the importance of these minor finger injuries and have advanced many and varied methods of treatment.

The important factors to consider are: (1) the important sensory function of the hand, especially the thumb, index and middle fingers; (2) the importance, especially to manual workers, of supple fingers of normal length, and (3) the fact that good skin covering is essential to both the aforementioned criteria and especially to prevent scarring and pain in the finger tips, which interferes grossly with the efficiency of the hand.

With these points in mind, the various methods of treatment should be mentioned critically.

1. Calculated neglect, i. e., treating the injury with dressings only. In such circumstances the wound heals slowly by granulation and usually leaves a firm, tender, painful fixed scar.

2. Replacement of the amputated part. This is occasionally successful, but more often the part is never found or is mutilated beyond the point of viability.

3. Shortening the digit to achieve primary closure of the skin. In rare instances this is the method of choice, but usually, after careful consideration, one of the methods of tissue replacement will give a far superior result.

4. Amputation of the digit at the site of election. This applies when complicated severe injuries to the skin, neurovascular bundles, bones, joints or tendons would preclude the return of useful function of the digit.

5. The use of free skin grafts. These grafts are highly valuable for *surface replacement only.* When loss of pulp or subcutaneous tissue is extensive, or when tendon or bone is exposed, pedicle coverage is much to be preferred.

6. The use of local flaps, which can occasionally be swung from the dorsal to the ventral surface of the same finger, with application of a Thiersch graft to the donor area. The indications for this method are limited.

7. The use of palmar flaps, which are widely used and very useful. The presence of a painful, tender scar on the pressure-bearing surface of the palm, however, is often a serious disability to a manual worker.

8. The application of pedicle flaps from other areas. Commonly the abdominal wall, the chest or the opposite forearm is used, but since the type of skin and fat in these areas is so unlike hand tissue one

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Sept. 8, 1956.

encounters a tremendous problem in fixation and nursing, this method is undesirable.

9. Finally, the employment of the so-called cross-finger pedicle method, which is designed to replace the missing portion with a similar type of skin and fat from the hand with a minimal nursing problem. It is particularly adapted to lesions in which bone or tendon is exposed and to preservation of length of the digit. It is also useful in the replacement of the bulk of the pulp when this important portion of the finger alone has been extensively damaged.

Disadvantages of the Cross-Finger Pedicle Method.—The technic has the following disadvantages:

1. The need for two operative procedures.

2. The possibility, increasing with the age of the patient, that some stiffness of the fingers may be caused by the fixation. We have found this of little or no practical importance, since it occurs only in a small percentage of cases.

3. Anesthesia of the flap. This is a relatively minor disadvantage, since it occurs with all other types of surface replacement and, in fact, is much more critical when sensation returns, because it is hand tissue with the necessary potentiality for manual sensation.

Planning the Flap.—The procedure entails the planning of a flap on the dorsum of an adjacent finger so that application to the existing defect can be accomplished easily and fixation maintained with a minimum of effort and a maximum of comfort to the patient.

Because of the excellent blood supply of the finger these flaps can be based proximally, distally, mesially, laterally, middorsally or obliquely with almost entire impunity. Careful, gentle handling, of course, is essential throughout.

1. When the finger is extended the knuckle pad over the dorsum of each joint is outlined by an oval of wrinkles. Although in some cases it is necessary, we try not to go closer to the joint than the outermost wrinkle of the oval (Fig. 1, *left*).

2. When the finger is fully flexed the flexor creases extend onto the mesial and lateral aspects of the finger. We use lines joining the ends of these creases as the limits, trying never to extend the incision onto the flexor surface of the finger beyond these lines (Fig. 1, *center*).

The roughly rectangular area thus outlined is the donor area within the confines

Fig. 1

Fig. 2

of which the flap is most ideally placed. Within these limits aforementioned, the flap can be planned safely as best suits the injury under treatment.

3. For loss of pulp or other flexor surface it can be based on either midlateral line and unfolded like an open book to be applied to the defect (Fig. 1, *right*).

4. For amputations of the guillotine type it can be based distally and lifted like a trapdoor for application to the end of the injured finger (Fig. 2, *left*).

5. For loss of the thumb tip, a flap based on the mid-dorsal line and elevated to this point from the midlateral line provides comfortable and adequate coverage. Here the middle finger is usually a more appropriate donor, because of the importance of the thumb side of the index finger in opposition and grasping (Fig. 2, *center*).

6. For dorsal injuries, if necessary, a proximally or distally based flap can be elevated and turned sufficiently to cover an exposed joint (Fig. 2, *right*).

Positioning the fingers is highly important for efficient use of the flap, for relieving tension on the suture lines and for the comfort of the patient. We have noted that mild flexion of the interphalangeal joints with variations of the amount of flexion at the metacarpophalangeal joints gives the best results and leaves very few situations in which easy, comfortable positions cannot be obtained. Crossing the fingers slightly so that some degree of overlapping is obtained is often useful.

Operative Technic.—The technic we employ entails the use of general anesthesia, principally for speed and convenience. Local or regional block is equally applicable.

With careful avoidance of the open wound, the injured extremity is washed, prepared with green soap, ether, iodine and alcohol and draped. The injury is then irrigated with saline solution, after which it is débrided and hemostasis obtained.

The next step, which we consider extremely important, is the creation of a bloodless field for dissection of the flap. This entails the use of a tourniquet on the upper part of the arm and an esmarch bandage as used in most operations on the extremities; or since this requires a relatively short time, an esmarch bandage alone may suffice, the distal portion being unwrapped to allow access to the operative area. The former, however, is preferred. This dissection must avoid the neurovascular bundles on the sides of the finger and must leave as thick a layer of areolar tissue over the extensor tendon as possible, elevating only fat and skin. After grossly identifiable vessels have been tied, the finger is wrapped with moist gauze and held snugly by the assistant or nurse

when the tourniquet is released and while the operating surgeon cuts a freehand graft of appropriate size. This can come from the flexor surface of the same forearm or the upper anterolateral aspect of the adjacent thigh. A moderately thick graft is preferable, since it minimizes contracture on the dorsum of the finger. When this has been obtained the finger is unwrapped, any further hemostasis necessary is obtained and the graft is sutured into the donor defect. Depending on the plan by which the flap was obtained, a small gauze bolus is tied over the graft or a thin layer of gauze is placed over it and the recipient finger brought into position on the gauze. The margins of the flap are then sutured to the margins of the injury. Zeriform gauze is applied to cover all suture lines, and a posterior plaster splint is fashioned to maintain the finger in position. A window is left over the flap suture line and, if possible, sufficient access to change the dressing of the graft without disturbing the position of the finger. Superimposed over this, and incorporating only the involved fingers, we use a fluffed gauze dressing. The first dressing is usually done in the hospital on the fifth postoperative day. Occasionally, if moisture persists around the flap or the graft, frequent dressings are necessary, in which case we keep the patient hospitalized. We have sent patients home, however, on the day of operation. We usually see them in the office for removal of the sutures after eight to ten days and again just prior to their admission to the hospital for the second stage. The interval averages sixteen to eighteen days.

The second stage consists of division of the pedicle. Granulations must be trimmed from under the base on the donor finger, so that it can be sutured to the edge of the now healed free graft. It is important not to undermine this graft, as any undermined portion will be lost. The edge of the injury must be freshened and any granulations trimmed, so that the edge of the flap can be sutured down with a minimum of undermining, thus protecting its blood supply. The fingers are then dressed individually. Unless unusual conditions exist, the patient is discharged on the following day and visits the office for removal of the sutures after six days. Very small bandages are usually reapplied and gentle active exercise begun. On about the tenth day the small bandages are removed and vigorous exercise is started so that by about the fourteenth day after the second stage procedure most patients are ready to return to work wearing some form of finger protection. The fingernail, when it regrows, is most often shortened or slightly deformed, depending on the type of injury, but up to the time of writing we have encountered no serious complications from this source.

SUMMARY

After pointing out emphatically that so-called minor finger injuries are usually anything but minor, the authors discuss the cross finger pedicle flap as employed in the treatment of such injuries. They list eight other methods of treatment briefly, pointing out indications and contraindications. In their hands the cross-finger pedicle flap has given highly satisfactory results. They admit that the procedure has some disadvantages, among which is the fact that the operation requires two stages, but lay stress on the fact that it provides the patient with easy, comfortable manual function. The technic they employ is described in detail.

RÉSUMÉ

Après avoir souligné que les lésions digitales soi-disant mineures sont en général tout sauf mineures, les auteurs discu-

tent le lambeau pédiculé des doigts imbriqués tel qu'll est utilisé dans le traitement de ce genre de lésion. Ils énumèrent brièvement huit autres techniques en mentionnant leurs indications el contreindications. Ils ont obtenu des résultats des plus satisfaisants par la méthode cidessus mentionnée. Tout en reconnaissant à cette technique certains désavantages—parmi lesquels le fait que l'intervention doit être pratiquée en deux temps,—ils soulignent qu'elle procure au malade une fonction digitale aisée. Les auteurs terminent par la description de la technique utilisée.

ZUSAMMENFASSUNG

Die Verfasser heben mit grossem Nachdruck hervor, dass die sogenannten geringfügigen Fingerverletzungen gewöhnlich alles Andere als geringfügig sind und erörtern dann die Behandlung solcher Verletzungen mit dem gestielten Lappen mit gekreuzten Fingern. Sie erwähnen noch kurz acht andere Behandlungsmethoden und gehen auf die Indikationen und Kontraindikationen ein. Sie selbst haben mit dem gestielten Lappen bei gekreuzten Fingern höchst befriedigende Ergebnisse erzielt. Sie geben zu, dass dem Verfahren einige Nachteile anhaften, zu denen die Notwendigkeit einer Operation in zwei Stadien gehört. Andererseits betonen sie, dass die Methode dem Kranken eine leichte und bequeme Funktion der Hand verschafft. Die von ihnen angewandte Technik wird in ihren Einzelheiten beschrieben.

RESUMEN

Después de señalar enfaticamente que las llamadas lesiones menores de los dedos generalmente distan mucho de ser menores, los autores discuten el colgajo con pedículo de dedos cruzados como lo emplearon en el tratamiento de esas lesiones. Enumeran otros ocho métodos de tratamiento brevemente, señalando indicaciones y contraindicaciones. En sus manos el colgajo con pedículo de dedos cruzados ha dado resultados altamente satisfactorios. Ellos admiten que el procedimiento tiene algunas desvenyajas, entre las cuales está el hecho de que la operación requiere dos tiempos, pero enfatizan el hecho de que provee al paciente de función manual fácil y cómoda. Se describe en detalle la técnica por ellos empleada.

RIASSUNTO

Dopo aver chiarito il concetto che i cosidetti traumi minori delle dita tutto sono tranne che minori, gli autori descrivono il lembo peduncolato crociato quale si usa nella cura di tali lesioni.

Elencano brevemente altri otto metodi, con le relative indicazioni e controindicazioni e affermano che il metodo crociato ha dato i migliori risultati. E' bensì vero che presenta alcuni inconvenienti, fra cui il dover essere eseguito in due tempi, ma ripristina nel modo migliore la funzione.

Viene descritta dettagliatamente la tecnica.

Plastic Surgical Management of Common Lesions of the Face and Oral Cavity

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IN dealing with malignant lesions of the head and neck one encounters chiefly the basal cell and squamous types of epithelioma. Other conditions, such as malignant melanoma and the ever-present hemangioma, also must be considered.

From the point of view of the plastic surgeon or any other surgeon who undertakes the treatment of such lesions, the objectives are clearly defined: (1) complete removal of all diseased tissue and (2) adequate reconstruction of the resulting defect, so that the patient is socially acceptable and can carry on his gainful occupation. Surgeons are naturally interested in accomplishing these ends by surgical methods rather than by other forms of therapy, such as electrodessication, cautery destruction or irradiation.

If all diseased tissue has been successfully removed, final reconstruction can be carried out immediately rather than postponed for some future date. One must be absolutely certain, however, that all of the malignant growth has been removed. Several steps are useful in this direction: 1. Outlining the area of the tumor and of the proposed excision with a skin dye before the injection of a local anesthetic into the surrounding tissues results in distortion of the features, or before partial incisions are made in the area. 2. Conducting an immediate check of questionable tissue by frozen section. This can give a clear idea of the progress of the tumor to the periphery and also to the depth of the excision. 3. Checking the results of routine pathologic examination against the frozen sections.

Once the diseased tissue has been removed, the surgeon's problem revolves around the satisfactory repair of the resulting defect to produce the second major aim aforementioned, namely, a reconstruction so satisfactory that the patient is socially acceptable and can carry on his work, so that he does not become a burden on his relatives or on some charitably supported organization. A number of procedures are commonly employed by the plastic surgeon to convert unsightly defects into satisfactory end results. It is the purpose of this paper to review briefly some of these methods and to demonstrate their application to various regions of the head and neck. They can be listed as follows: (1) direct closure; (2) extensive undermining with direct closure; (3) the use of local flaps; (4) the use of split thickness skin grafts; (5) the use of full thickness skin grafts; (6) the use of distant flaps; (7) the use of composite grafts, and (8) metallic reconstruction of the mandible after radical resection of the neck and jaw.

Let us first consider conditions involving the nose. Direct closure on the dorsum, where the skin is relatively limited, is rarely possible, and it is usually neces-

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Jan. 11, 1957.

sary to apply a distant graft for a sizable defect. The graft for this purpose is the full thickness skin graft, and the donor sites of choice are the supraclavicular area and the postauricular region. When the excision is done for lesions scattered over the entire dorsum of the nose and a full thickness graft seems inadvisable because of the large area to be covered, a split thickness skin graft removed from the thigh or the abdominal wall should be chosen. In dealing with smaller lesions on the lateral aspect of the nose it is possible to make use of local flaps to cover the resulting defects. These flaps may be based either inferiorly (when the bulk of the tissue comes from the region of the nose and the lower eyelid) or superiorly (when the tissue comes from the nasolabial or the labiobuccal fold). For lesions at the margin of the ala, where the full thickness is involved or where, because of the inflammatory reaction associated with the lesion, it is impossible to decide upon a compromise, the entire thickness of the ala should be removed. The resulting defect in this condition is adequately managed by the use of a composite graft. Such a graft is usually taken from the base of the helix of the ear and includes a double layer of skin and subcutaneous tissue with an intervening leaflet of cartilage. A graft of satisfactory size can produce a most favorable result. The secondary defect in the ear is easily closed by direct suture, and the end result is not particularly conspicuous. For deeper-seated lesions of the nose that involve bone and perhaps underlying mucous membrane, a full thickness excision is required, and in the reconstruction of such a defect a distant flap, such as a forehead flap, is required. Of course, this enters into the field of multiple-stage operations, but even though the end result is somewhat delayed it can be quite pleasing. The secondary defect in the region of the forehead is covered immediately with a split thickness skin graft and, after division, the unused portion of flap is returned to the forehead.

Small lesions of the eyelids, particularly of the upper lid, allow wide excision with direct closure, for an abundance of skin from the upper eyelid is always available for such a procedure. When the lesion is near the palpebral border, a long horizontal incision can be made, the skin of the upper lid being advanced, for a satisfactory result. Carcinoma of the lower eyelid, which tends to involve a moderate proportion of the total length of the lid, can best be treated by a wide V type of excision with advancement of a skin flap from the cheek. In this procedure, the conjunctiva from the lateral aspect of the lid and the conjunctival sac is advanced medially with the skin flap. On occasion it is necessary to undermine the conjunctiva extensively and even to borrow some of the bulbar conjunctiva in the reconstruction.

A certain number of lesions appear to involve both nose and eyelid. These are the ones commonly present near the inner canthus. With these it is usually routine to take as much skin and subcutaneous tissue as is deemed necessary from either the upper or the lower lid, or both, and leave, if possible, the tarsal plate or at least the conjunctiva. The remaining portions of the lids are sutured together, and the entire defect is covered with a supraclavicular full thickness skin graft. If the reconstruction is extensive enough to impair vision, the graft and conjunctiva can be divided and sutured to reconstitute the medial portions of the upper and lower eyelids after three or four months have passed.

Epitheliomas of the ear usually permit wide excision, for here one is dealing with an organ which, at times, appears to be completely expendable. In a case of extensive carcinoma, great portions of the ear,

or indeed the entire ear, can be removed without difficulty. Prosthetic appliances made of latex and glued to the scalp in the mastoid region offer satisfactory camouflages. When smaller lesions are present, certain portions of the ear can be removed through elliptic incisions without producing any particular distortion of the ear. The use of full thickness skin grafts on the anterior aspect of the ear for lesions involving the underlying cartilage, when excision of all but the posterior skin of the ear is required, is a common and satisfactory procedure.

In dealing with the scalp, it is usually possible to close large defects with local flaps. This is particularly important in treating a woman or a man who still has a full head of hair. Hair-bearing scalp can be moved to cover large defects. The secondary defect created can be covered with split thickness skin grafts and the hair trained over the bald area produced by the skin grafts. The area of scalp thus moved can be considerable, and the coverage by hair can be quite satisfactory. Children have a tendency toward hemangiomas, some of which grow very rapidly and require extensive excision, even at an early age. The resulting defect can usually be closed without difficulty by proper undermining of the tissues adjacent to the defect. It is desirable in certain cases to make absolutely certain that undue tension is not placed upon the eyebrow, pulling it up out of position, or that the normal hairline is not distorted by being pulled over the forehead. When the patient is completely bald, the use of full thickness skin grafts on the scalp is entirely satisfactory.

In the cheek the tissues are quite lax, particularly in the elderly and aged, and, as age advances, the opportunity for use of large cheek flaps increases. Some of these cheek flaps can involve a major portion of the cheek, others only a partial advancement. The use of the skin closest to the area of excision is always, of course, the most desirable, and it is only in rare cases, in which extensive and multiple lesions involve large areas of the cheek, that the split thickness skin graft is used. When partial or complete resurfacing of a cheek is necessary, however, the split thickness skin graft serves a useful purpose.

Parotid tumors present a number of problems known to all surgeons. These hinge around (1) complete removal of the tumor and (2) preservation of the facial nerve. Identification of the facial nerve by using the posterior facial vein as a landmark, as pointed out by Dr. Louis Byars, makes for adequate removal of the tumor without injury to the nerve in most cases. The size of the tumor can, on occasion, be considerable, but the same basic technic can produce a satisfactory result.

Lesions of the upper lip are relatively uncommon; they do appear at the base of the ala, in the fold between the lip and the cheek. These lend themselves to adequate excision with favorable reconstruction of the upper lip, and no major distortion is involved. The ordinary isolated lesion of the lower lip is well handled by a V type of excision. Apparently, if one follows the normal cutaneous folds, a more pleasing result can be obtained than when the excision is made in a completely vertical direction. For multiple lesions of the lip, or when the vermilion border of the lower lip is extensively involved by leukoplakia, the combination of a single or double V type of excision, plus complete excision of the vermilion border with advancement of the mucous membrane of the lower lip to reconstruct it, results in a satisfactory postoperative condition.

Operation on the tongue for areas of leukoplakia or early squamous cell carcinomas is perhaps acceptable. Operation for extensive lesions of the tongue when

the major portion of the tongue must be excised is likewise acceptable and, on occasion, is the method of choice. Ordinary or average lesions of the tongue are perhaps better treated by cautery excision plus the implantation of radon seeds and a prophylactic dissection of the neck. Lesions of the buccal mucous membrane can sometimes be excised and inlay skin grafts inserted. For elderly persons, whose tissues are relaxed, direct closure is the method of choice. When the mandible is involved, a combined radical resection of the neck and jaw must be performed; in such cases I use a metal rod to reconstitute the removed section, so that the remaining teeth may have normal occlusion and the facial contours be maintained.

SUMMARY

The author briefly reviews various plastic surgical procedures to reconstruct defects of the head and neck after excision of malignant lesions in these areas. These include (1) direct closure; (2) extensive undermining with direct closure; (3) the use of local flaps; (4) the use of split thickness skin grafts; (5) the use of full thickness skin grafts; (6) the use of distant flaps; (7) the use of composite grafts, and (8) metallic reconstruction of the mandible after radical resection of the neck and jaw. These are merely adjuncts to the author's stated aim in the treatment of malignant lesions, namely, complete removal of all diseased tissue and adequate reconstruction of resulting defects, so that the patient may return to his normal place in society.

RÉSUMÉ

L'auteur passe brièvement en revue les différentes techniques chirurgicales de reconstruction plastique de la tête et du cou après excision de lésions malignes. Celles-ci comprennent: 1) la suture directe; 2) l'excision large en profondeur avec suture directe; 3) l'utilisation de lambeaux locaux; 4) l'utilisation de greffes cutanées dédoublées; 5) l'utilisation de greffes cutanées totales; 6) l'utilisation de lambeaux éloignés; 7) l'utilisation de greffes mixtes, et 8) la reconstruction métallique du corps de la mandibule après résection radicale du cou et des mâchoires. Ces méthodes ne sont que des auxiliares dans le but à atteindre lors du traitement des lésions malignes, qui est l'excision totale de tous les tissus pathologiques, suivie d'une reconstruction satisfaisante de sorte que le malade puisse retrouver sa place normale dans la société.

RESUMEN

El autor revisa brevemente varios procedimientos plásticos quirúrgicos para reconstruir defectos de la cabeza y el cuello después de la excisión de lesiones malignas en esas áreas. Estas incluyen: (1) cierre directo; (2) movilización excesiva de colgajos con cierre directo; (3) el uso de colgajos locales; (4) el uso de injertos de piel de grosor medio (5) el uso de injertos de piel de grosor total; (6) el uso de colgajos distantes; (7) el uso de injertos complejos y (8) reconstrucción de la mandíbula con partes metálicas después de resección radial del cuello y maxilares. Estos son procedimientos puramento adjuntos a los mencionados por el autor en el tratamiento de lesiones, malignas, en otras palabras, extirpación completa de tejido enfermo y reconstrucción adecuada de los defectos resultantes, para que el paciente pueda retornar a su lugar normal en la sociedad.

RIASSUNTO

L'autore tratta brevemente dei vari metodi plastici per la riparazione delle

perdite di sostanza del capo e del collo consecutive ad asportazione di tumori maligni.

Tali metodi consistono 1) nelle sutura diretta; 2) nella distruzione estesa con sutura diretta; 3) nell'uso di lembi plastici; 4) nell'uso di trapianti cutanei a mezzo spessore; 5) nell'uso di lembi a tutto spessore; 6) nell'uso di lembi prelevati a distanza; 7) nell'uso di trapianti misti; 8) nella ricostruzione metallica della mandibola dopo resezione.

Tutto ciò serve come complemento alla cura delle lesioni maligne, che consiste essenzialmente nella rimozione completa di tutti i tessuti colpiti e nelle ricostruzione delle perdite risultati così il paziente possa riprendere il suo posto nella società.

ZUSAMMENFASSUNG

Der Verfasser gibt einen kurzen Überblick über die zur Deckung von Defekten am Kopf und Hals nach Resektion bösartiger Erkrankungen angewandten plastischen chirurgischen Verfahren. Zu diesen gehören 1) direkter Verschluss; 2) umfangreiche Unterminierung mit direktem Verschluss; 3) Verwendung örtlicher Hautlappen; 4) Verwendung von dünn geschnittenen Hauttransplantaten; 5) Verwendung von Hauttransplantaten voller Dicke; 6) Verwendung von Hautlappen aus entfernteren Körpergegenden; 7) Verwendung zusammengesetzter Transplantate und 8) Wiederaufbau des Unterkiefers mit Metall nach radikaler Hals- und Kieferresektion. Diese Massnahmen sind nur zusätzliche Hilfsmittel, deren sich der Verfasser bedient, um sein Ziel in der Behandlung bösartiger Erkrankungen zu erreichen, d. h. die völlige Entfernung allen erkrankten Gewebes und eine ausreichende Wiederherstellung der entstandenen Defekte, sodass der Kranke zu seinem normalen Platz in der Gesellschaft zurückkehren kann.

. . . Since I am upon so pleasing a topic as self applause, give me leave to say that the circle of science which I have run through before I undertook the study of physic, is not only useful, but absolutely necessary to the making a skilful physician. Such sciences enlarge our understanding, and sharpen our sagacity; and what is a practitioner without both but an empiric, for neer yet was a disorder found entirely the same in two patients. . . .

—*Goldsmith*

Surgical Treatment of the Male Genitalia

With Special Reference to the Use of Periosteal Bone Graft in Constructing the Penis

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RECONSTRUCTIVE surgical treatment of the male genitalia is a fascinating but rather difficult field, demanding the best that a plastic surgeon can offer, both in planning and in proper execution.

A satisfactory reconstruction of the penis was first reported in 1936 by Bogoraz,[1] who after several plastic procedures restored the major portion of a penis lost in an accident. Others who contributed to this subject are Blum[2] (1938), Frumkin[3] (1943), Bergman and his co-workers[4] (1948), Paletta,[5] Goodwin and others[6] (1952), Chapell[7] (1953) and Farina and his associates[8] (1954). Most of these authors have used an abdominal tubed flap or scrotal tissue to construct the phallus and a cartilage or acrylic transplant to stiffen it.

Although cartilage gives a good immediate result, after some months it curves upon itself and no longer serves its purpose as a baculum. Some patients do not tolerate acrylic splints.[6]

I have used periosteal bone graft for splinting the newly constructed penis and also in certain cases of impotence. The results have been encouraging. Further, bone is a physiologic component of the penis in some mammals, e. g., the dog, the bear and the baboon. In animals the os penis serves to produce a rapidly erectile state of the organ and assists in copulation.[9]

Construction of the Penis (Phalloplasty).—I had the opportunity to construct a penis of good appearance and adequate function in a pseudohermaphroditic patient with hypospadias by a method somewhat different from those described in the literature, giving gratification to both the patient and his partner during coitus and not hurting either.

REPORT OF CASE

Mrs. D. Khatoon (now Mr. D. Khan, a farmer from Larkana, Sind, Pakistan) was admitted to Surgical Unit No. 1, Civil Hospital, Karachi, on Aug. 4, 1953.

The patient had been married for more than twelve years, but had never menstruated and never conceived. As a result of increasingly violent quarrels, the District Magistrate had separated her from her husband. The patient cropped her hair, discarded the female clothes and started a small grocer's shop. "She" wanted to look like a man in order to get along with "her" changed occupation. For this purpose "she" came to the hospital with a request for the construction of a moustache.

On examination and investigation she was found to be a pseudo-hermaphrodite. Two small nodules were present in the labia majora. The labia minora were rather ill defined. The vagina comfortably admitted a large speculum. The urethra was situated at the anterior wall, a short distance from the vaginal opening. The clitoris was small (Fig. 1).

The right nodule, on histologic examination, proved to be an undeveloped testis.

With intensive hormonal therapy, the labial folds, which were actually the testicular folds, grew into pouches, and the appearance of the genitalia assumed the form of pseudohermaph-

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Read at the Twentieth Anniversary Meeting of the International College of Surgeons, Geneva, May 1955.

Submitted for publication Oct. 26, 1956.

roditic hypospadias (Fig. 2A). The rudimentary penis, which was smaller than the normal clitoris, remained unaffected. The large breasts retrogressed well. The lips remained hairless, and the chin was almost bare except for a few hairs on either side. There was no hair on the chest and legs.

A moustache was constructed from the hairy skin of the scalp (Fig. 5). Phalloplasty was then performed.

Operative Technic: Reconstruction of the penis is carried out in many stages and usually requires about six to nine months.

First Stage. A large abdominal tube pedicle was constructed from the skin, subcutaneous tissue and fat (Fig. 2*A*). Two parallel curved incisions (for elevating the flap) were so planned that later, when the upper end of the pedicle should be severed and transplanted to the hand, it would not twist. Thick interrupted chromic catgut sutures were used to unite the fatty layer of the superficial fascia of the abdomen in converting the flap into a tube (*a*, Fig. 4). The tissue reaction of the catgut finally leads to the production of a strong ridge of fibrous tissue in the pedicle which makes it somewhat stiff (*b*, Fig. 4).

Second Stage. The lower end was severed and transplanted to the hand on the same side (Fig. 2). I like to avoid direct transplantation of the abdominal pedicle to the subsymphysial region, as this produces an undesirable twist of the pedicle.

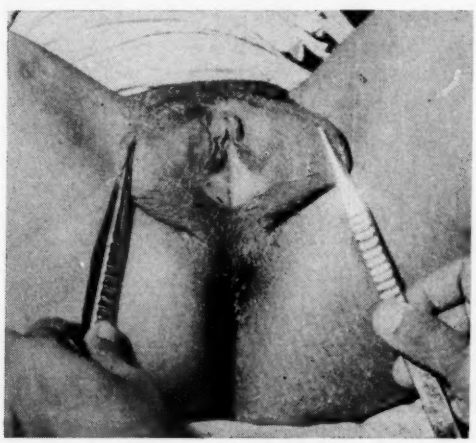

Fig. 1.—So-called vagina and clitoris (rudimentary penis). Appearance after a few months of hormonal therapy, with some development of testes and scrotal sacs. Abdominal pedicle is covered with many-tailed bandage.

Before the connection of the tube pedicle was severed at any point it was conditioned for several days. A fine rubber tube was applied to the end of the pedicle to be severed for about ten minutes every three hours, and the time interval being made progressively longer and more frequent until, on the day before disconnection, the rubber tube was left tied to the tube pedicle for about twelve hours. Absence of change in color and of lowered temperature at any part of the pedicle were considered safety signs that disconnection will be safe.

Third Stage. The pedicle was disconnected from the abdomen. A triangular flap of skin was raised below the symphysis pubis, with its base towards the vagina.

The rudimentary clitoris-like penis was dissected, to be used as a central peg, and the tube pedicle was grafted over it and sutured to the subsymphysial region by interrupted stitches (Fig. 2*B*). This little penile stump under sexual impetus produces the elevation of the newly constructed phallus with its bony baculum (Fig. 2*C*).

Fourth Stage. A massive bone graft about 10-11 cm. long with a larger periosteal segment was obtained from the tibia (Fig. 5). On the upper part of the tibia, two 14 cm. parallel incisions were made 3 cm. apart. Both ends of the incisions were joined. The periosteum was elevated a little more than 0.5 cm. along the longitudinal incisions and at the lower end. More than 3 cm. of periosteum was elevated at the upper end. Fine drill holes were made 1 cm. apart to map out a bone graft about 10 cm. long and 1.5 cm. broad. With the help of osteotome and hammer this bone graft was elevated, together with the large segment of periosteum, which is kept attached to it. The ends of the bone graft were rounded off and a fine hole drilled at the long periosteal end.

Two short longitudinal incisions were made in the pedicle, at its proximal and its distal end. These incisions were connected by making a subcutaneous tunnel in the pedicle to receive the bone graft. The proximal incision also exposed the rudimentary clitoris-like penis peg.

A stout chromic catgut suture was passed through the hole in the bone at the long periosteal end of the bone graft and through the penile peg and was then tied. A few stitches sutured the flap of periosteum to the rudimentary penis. The bone graft was thus firmly anchored to the penile peg.

Fifth Stage. A broad strip of fascia lata about 20 cm. long was obtained from the patient's thigh. The lower end of it was split to encircle the proximal part of the bone graft and was sutured in place. A few stitches were also applied to anchor the strip proximal to this slit to the periosteum.

The remaining strip was passed through a subcutaneous tunnel in the midline, to come out of a transverse slit in the rectus sheath and be anchored to it.

Through another transverse slit in the rectus sheath, the fascia lata was buried deep to it and anchored to the muscle. The fascia lata transplant acts as a suspensory ligament and elevator muscle to the artificial os penis (Fig. 2*C*).

Sixth Stage. The pedicle was separated from the hand. A meatal dimple was created by making a small longitudinal midline slit in the skin of the severed flap, dissecting a small quantity of the fat around the slit and drawing the lips of the incisions inward with a stitch of catgut on either side. The flap was turned over the raw lower end of the pedicle graft and sutured onto the ventral surface, forming the rounded distal end and beginning the construction of the glans for the new phallus. The linear scar on the undersurface of the pedicle now lay between the triangular flap of new glans and the symphysial flap at the root of the new phallus (*f*, Fig. 4). Subsequent contraction of the scar, therefore, did not cause any bending of the organ.

Seventh Stage. About two weeks later a circular incision was made, running downward and forward at the site of the proposed coronoglandis sulcus, a small skin flap being raised on the distal end of the pedicle (*c*, Fig. 4). The flap was 4 mm. broad on the dorsal surface but tapered toward the midline ventrally, (The intact bridge of skin on the ventral surface is an additional safeguard in maintaining good vascular supply to the distal end.) From the exposed raw tapering surface a little quantity of fat was snipped out dorsally and laterally without interfering with the vascular supply of the distal end (*d*, Fig. 4). A few telescoping mattress sutures were applied to narrow the exposed raw surface. The skin flap was turned back, folded and sutured to the proximal cut edge of the wound.

Fig. 2.—*A*, newly constructed thick tubed pedicle with relief nicks on abdomen. Note development of scrotal folds and absence of penis. *B*, abdominal tubed pedicle transferred to hand and later attached to subsymphysial region. Through two dorsal stab incisions, tunnel was made in tubed pedicle and tibial bone graft with periosteum implanted. *C*, reconstructed penis being elevated by voluntary contraction of rectus abdominis muscle, through the newly constructed elevator apparatus. Organ comes into normal position of function by erection of penile peg to which new os penis is attached.

A slightly elevated ridge was produced on the dorsal aspect of the distal end of the new phallus, which gradually disappeared toward the midline on the ventral surface (*e*, Fig. 4).

I delayed considerably the disconnection of the newly constructed penis from the hand, in order to prevent the patient from using it until it was satisfactorily made. Further, I wished it to be delayed till the small nodules in the redundant labia majora or, more accurately, the scrotal folds, developed into good-sized testes.

With intensive hormonal therapy the testicular nodules did develop to nearly the normal size in about twenty months. The one from which a biopsy specimen had been taken was not as good as the other.

The patient is happy and well satisfied with the success he has had from the newly constructed organ in normal sexual relations. He indulges in coitus to the entire satisfaction of himself and his partners. He is able to keep the newly constructed penis erect mainly because of the tumefaction of the penile peg and partly by voluntary elevation through the new elevating apparatus. Sensitivity to touch developed first in the skin of the newly constructed phallus; sensitivity to pain and heat developed later. The bone graft after more than three years shows no sign of absorption.

Reconstruction of Partially Amputated or Damaged Penis.—In cases of advanced carcinoma of the penis, subtotal amputation is inevitable. Occasionally the damage is the result of accident. Sometimes it is the result of a deep burn, particularly if aphrodisiac ointments containing cantharides or other severe irritants have been liberally applied. I also had the opportunity of reconstruction in a case of the last-mentioned variety, in which most of the corpora had sloughed out.

In such cases the penis is reconstructed by means of a thick abdominal tube pedicle. The circumference of the tube is somewhat larger than that of the stump. The tube can either be "caterpillared" or, as I now prefer, transplanted through the hand as aforedescribed, because undesirable kinking and twist are avoided and the scar lies in the midline, hidden on the ventral surface.

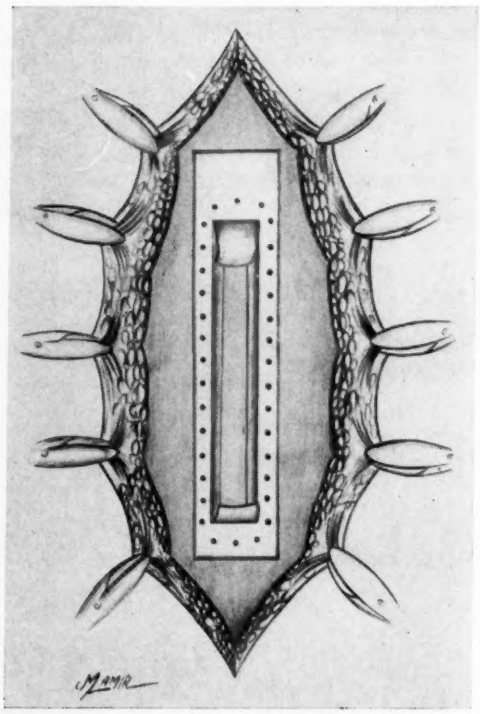

Fig. 3.—Procedure for obtaining a bone graft with larger periosteum from tibia of patient. Periosteum is partially elevated. Bone to be removed is outlined with drill holes. Careful chiseling is employed between drill holes to remove bone graft without chipping, cracking or fracturing.

During the second World War, because of the shortage of catgut, I was forced to use stout No. 1 to stitch together the fatty layer of the superficial fascia of the abdominal flap to form the tube pedicle. The tissue reaction to this embedded thick catgut resulted in a dense linear scar that penetrated the depth of the pedicle and made it firm and semistiff (*a* and *b*, Fig. 4). I now purposely use interrupted sutures of thick chromic catgut to attach the fatty layer of superficial fascia in making the pedicle and to obtain some degree of stiffness in it.

I have used cartilage grafts embedded

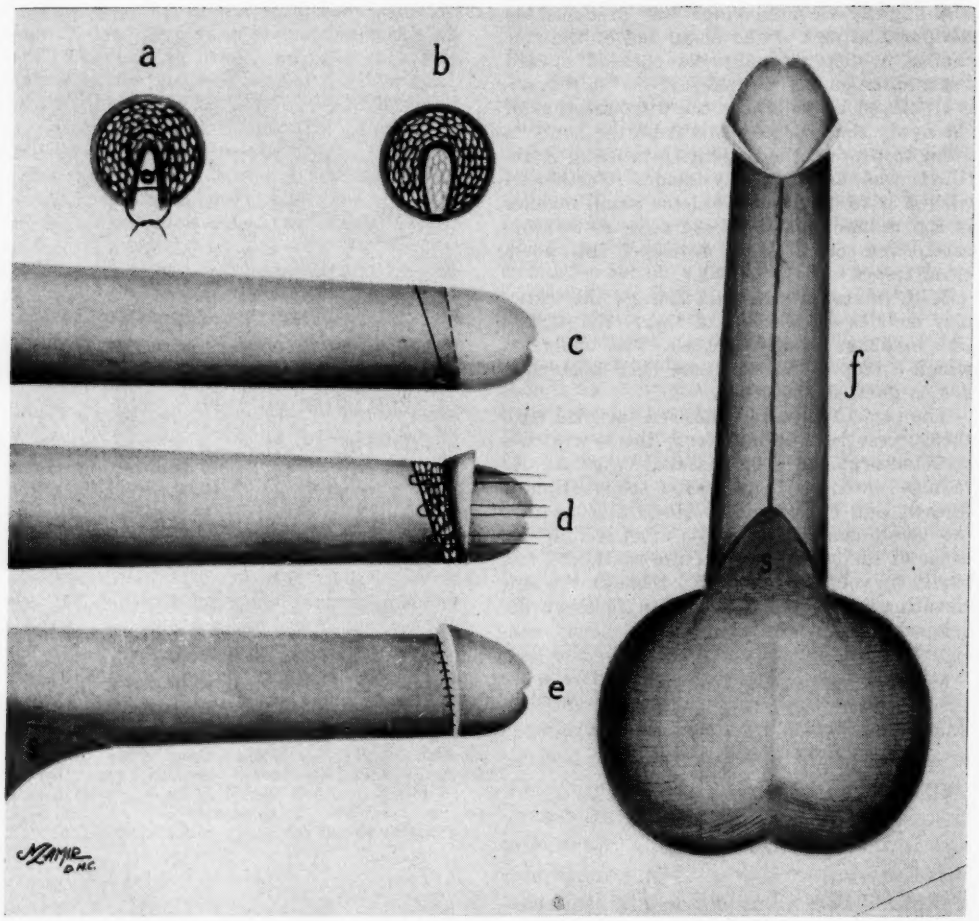

Fig. 4.—Cross section of tubed pedicle (*a*) showing one of thick buried catgut stitches used in approximating inner raw fatty surface during tubing of flap; also one of interrupted cotton stitch sutures approximating edges of skin. A ridge of dense fibrous tissue (*b*) is produced by tissue reaction to buried catgut, giving some degree of stiffness to pedicle. Incision for raising tiny flap on distal end of pedicle is shown in *C*. Shadow line denotes extent of dissection. In *d*, note that from exposed raw tapering surface a little fat is snipped cut dorsally and laterally without interfering with vascular supply of distal part. A few telescoping mattress sutures are applied to narrow exposed raw surface. Skin flap is turned back (*e*), folded and sutured to proximal cut edge of wound. A slightly elevated ridge is produced on dorsal aspect which gradually disappears towards midline on ventral surface. Ventral aspect of the reconstructed penis (*f*) shows that contraction of the midline scar does not produce bending of new penis, owing to resilient scrotal flap *S*.

in both the crura of the stump to obtain a stiff organ for good function.

Although the patients as a rule were easily pleased, having already reconciled themselves to the unfortunate results of damage or injury, I was still dissatisfied

with the functional value of the reconstructed penis. For a few years I kept thinking of providing an artificial os penis in these cases. When I finally did, the result was gratifying.

A bone graft from the tibia appears to be ideal for making the reconstructed organ stiff enough for good function.

For constructing the urethra in such cases a tubed pedicle of the desired length is made in the midline of the scrotum. In a young patient the urethra is constructed according to the technic of Bergman, and the resulting raw surface on the ventral or scrotal side of the phallus is covered by opening up the scrotal pedicle and suturing it over this raw area. In an elderly patient the simple method of Frumkin is adopted; one attaches the scrotal tubed pedicle along two parallel incisions on the ventral surface of the new penis. The new urethra lies between the abdominal and scrotal tubes that comprise the new phallus. In cases of reconstruction following amputation for carcinoma of the penis, however, construction of the urethra is often dispensed with by creating a permanent perineal urethrostomy.

Repair of Denuded Penis and Damaged Scrotum. — The penis is sometimes entirely stripped of its skin when accidentally caught in machinery. It loses its skin in cases of burn. It is also denuded as a result of excision of the elephantoid skin.

In cases of clean and fresh injury, after bone-dry hemostasis has been obtained, a split skin graft is applied with the penis in a state of moderate traction. Two stay sutures in the glans on either side are used for traction. The graft takes well, is movable and has good functional value.

When there is infection, as soon as it is controlled I prefer to embed the penis in a scrotal tunnel to give it a new covering. In such cases this procedure seems more satisfactory, because the possibility of not "taking" is minimized and the undesirable subepithelia fibrosis that commonly occurs in such cases is eliminated.

In cases of damage to the scrotal skin, if one-third is left intact, primary closure is often made possible by undermining at the base of the flap and borrowing somewhat from the thigh.

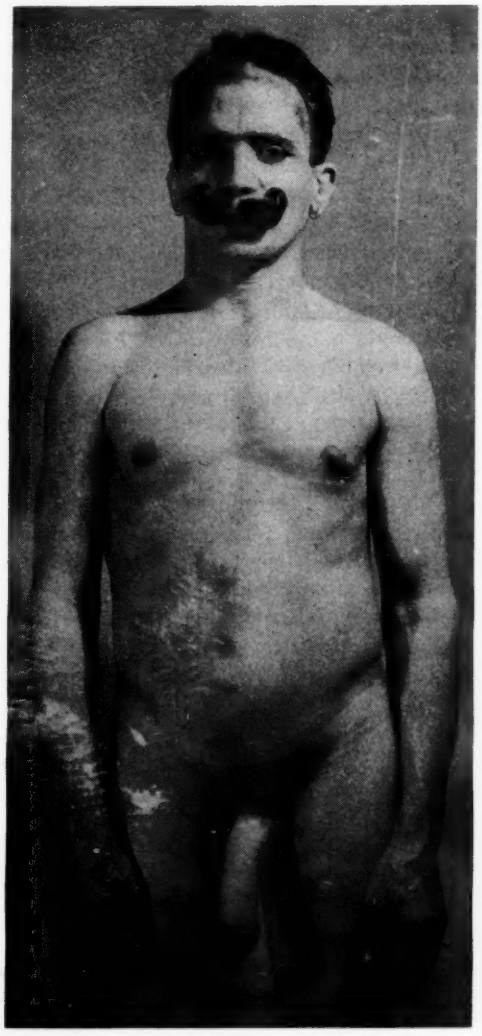

Fig. 5.—Reconstructed penis of desired size, hanging normally. There is a semblance of glans and sulcus behind it.

In cases of total loss, thigh flaps are considered suitable for reconstruction. Transplantation of the testes into the thigh is undesirable cosmetically and also because it subjects them to unnecessary trauma.

Surgical Treatment of the Impotent.— Encouraged by the good results of bone grafting obtained in the field of constructive surgical operations on the penis, I have extended its use in certain selected cases of advanced impotency. The proverbial stiffness is given to the penis, and its functional value is enhanced.

SUMMARY

A new technic of phalloplasty is described. A bone graft with larger periosteum from the tibia is considered an ideal physiologic baculum.

Other reparative and reconstructive problems of the region are discussed.

RÉSUMÉ

Une nouvelle technique de phalloplastie est présentée.

La greffe osseuse avec un périoste plus étendu du tibia est considérée comme un baculum physiologique idéal.

D'autres problèmes de chirurgie réparatrice et reconstructive de cette région sont discutés.

RIASSUNTO

Viene descritta una nuova tecnica per la falloplastica. Il trapianto ideale viene considerato quello osseo-periosteo prelevato dalla tibia.

Vengono discussi altri problemi analoghi di ricostruzione.

RESUMEN

Se describe una nueva técnica de faloplastía.

El injerto de hueso con periósteo grande de la tibia se considera como un báculo fisiológico ideal.

Se discuten otros problemas de reparación y reconstrucción de la región.

ZUSAMMENFASSUNG

Es wird eine neue Technik der Penisplastik beschrieben.

Eine Knochentransplantat mit reichlich Periost vom Schienbein wird als ideales physiologisches Glied angesehen.

Andere Wiederherstellungsprobleme dieser Körpergegend werden erörtert.

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An Articulated Acrylic Prosthetic Structure for the Repair of Flat Nose

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MEXICO D. F., MEXICO

THE use of an L-shaped structure to restore the nasal pyramid in cases of flat nose has been recommended by almost every author who has written on this subject. This L-shaped transplant has been made, in most cases, of either cartilage or bone.

In my own practice, the use of either fresh or preserved cartilage for this purpose has failed to produce satisfactory results in a considerable percentage of cases, for the following reasons: (1) the occurrence of reabsorption; (2) the development of torsion or flexion, and (c) the impossibility of managing small defects.

With reference to the use of bone in operations of this type, my experience indicates the following disadvantages:

1. An additional operation is needed when fresh bone is used. The only alternative is maintenance of a bone bank in order to have preserved bone always available.

2. The ultimate shape of the nose must be planned at the time of operation, with loss of time needed for other purposes and an improvised result.

The desirability of a device that would permit the surgeon to plan the shape of the corrected nose in advance of the surgical procedure is obvious. The disadvantages associated with both bone and cartilage as transplants led me to the use of an L-shaped acrylic prosthesis with vitallium reinforcement, divided into two parts, which up to the time of writing has given excellent results from both the functional and the esthetic point of view.

Technic. — Preliminary Procedure: On initiation of the use of the L-shaped acrylic prosthesis, I proceeded in the same manner as with bone and cartilage; i.e., a whole-piece structure was introduced through a large external incision in the columella. The following disadvantages were promptly noted: (1) an increase in operating time; (2) a larger scar, and (3) occasional disruption of the wound.

To eliminate these disadvantages, a two-piece structure was designed, articulated at the angle by means of a trigger mechanism.

The use of this supporting structure has proved advantageous in the following respects: (a) operating time is lessened; (b) the technic is simplified; (c) a very small incision enables the surgeon to introduce the structure; (d) there is no wound disruption, and (e) patient tolerance is 100 per cent.

Shape of Prosthetic Structure: The structure is made in two sections, one dorsal and one columellar (*1*, Fig. 1).

The dorsal portion is constructed sufficiently high to reach the nasion. (It is visible under the skin if placed lower, and it alters the normal shape of the nasal angle if placed higher.)

The lower part of this dorsal section is very thin; it will restore the prominence of the nasal lobule. Into this part the columellar portion of the structure will be articulated.

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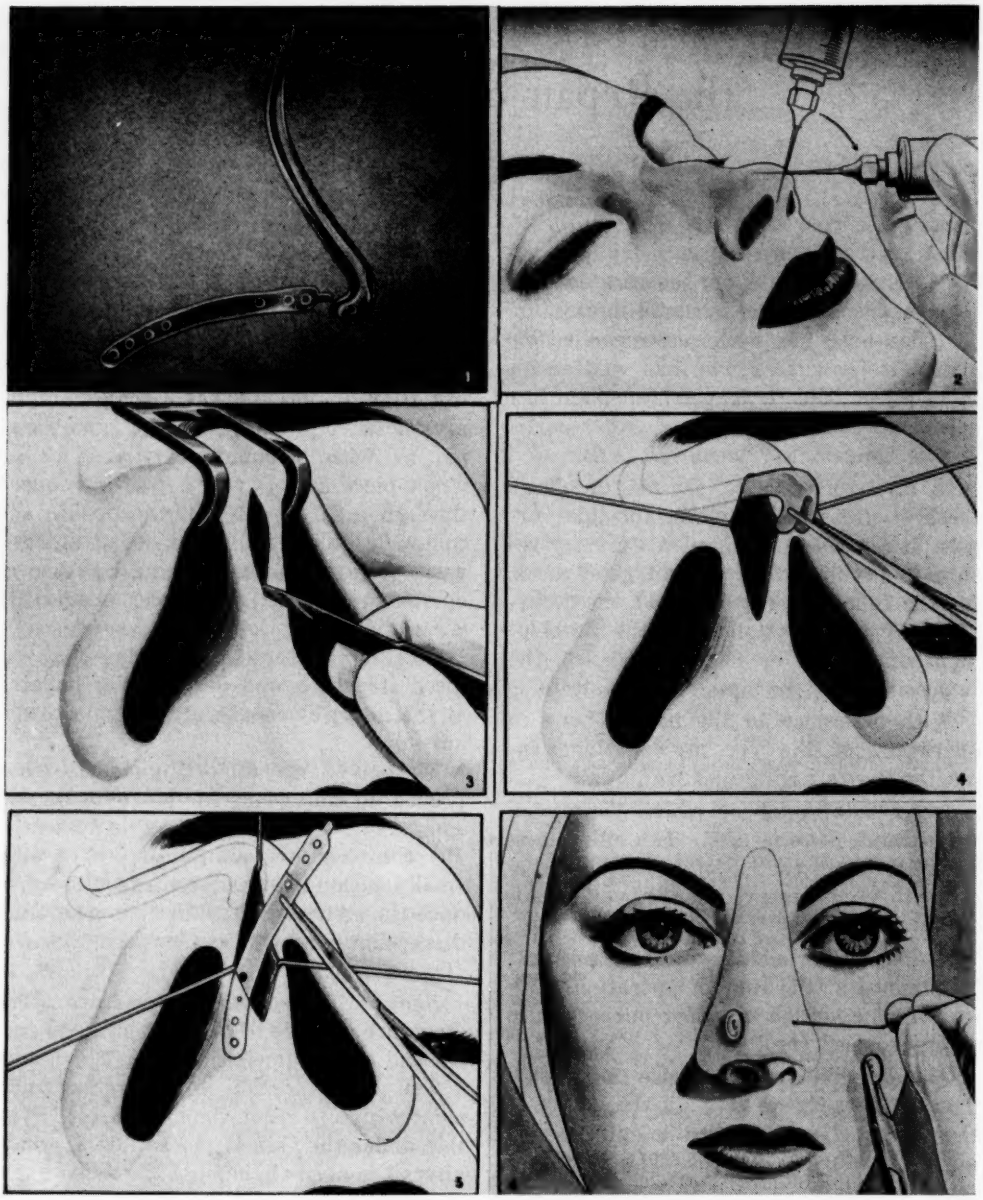

Fig. 1.—Operative technic (see text).

The columellar portion is very thin. It carries a piece of vitallium in its anterior end, which is articulated with the corresponding end of the dorsal portion. I have acquired the habit of making this section sufficiently long to be cut at the moment

during the operation when the nose has acquired the desired shape.

Both portions of the structure have several perforations to make them lighter and to allow their fixation in place.

Construction of Prosthetic Structure: A mold of the defective nose is taken and corrected. The positive mold of the defective nose and the negative mold of the corrected nose are set against each other and filled with wax. The result is a model of the needed structure, which should be lengthened in the columellar portion to obtain the desired projection of the nasal tip.

The wax model of the structure is pressed in a dentist's muffle. The wax is liquefied by immersion in hot water for a few seconds. The hollow left when the wax disappears is occupied by an acrylic paste made by mixing a polymerid powder and an isomeric liquid. Pressure is applied several times to prevent bubbles, and a small piece of vitallium is placed according to the need of the individual patient.

The pressed piece is wrapped in tinfoil and placed in the mold, which, mounted in a pressure press, is immersed in boiling water for one hour.

The structure is polished and perforated with a dentist's drill. Sterilization is done in the autoclave with the surgical instruments.

Manner of Introduction: The nose in its entire extent is infiltrated with one point of a local anesthetic (2 per cent procaine hydrochloride plus epinephrine) in the lobule, the needle pointing to the nasal root and changing its direction to the nasal spine (*2*, Fig. 1).

An incision 6 or 7 mm. long is made in the middle portion of the columella (*3*, Fig. 1) to a depth that reaches the nasal septum through the columellar portions of the alar cartilages.

Undermining is performed upward to the nasion and backward to the nasal spine. Sufficient lateral undermining must be done to enable the surgeon to introduce the structure without tension, and to insure that, on contraction of the skin, the prosthesis is not compressed.

Great care must be taken to avoid perforating the skin and the mucous membrane.

The dorsal portion of the structure is first introduced, care being taken to keep its inferior portion far from the cutaneous incision. The columellar portion is then introduced (*4*, Fig. 1). The inferior end of the dorsal piece is lifted with a hook until the projection desired for the nasal tip is obtained (*5*, Fig. 1). This point is marked in the columellar piece, which is extracted again in order to section the necessary portion and then restored to its place, in which it is articulated with the dorsal structure. Two or three stitches are applied in the alar cartilages with stainless steel wire No. 38 in an atraumatic needle. The skin is closed with separate stitches of No. 5-0 dermalon.

Postoperative Care.—A plaster of paris splint is applied. It is maintained in place with a transfixion point (made with stainless steel wire tied over ordinary buttons) and adhesive tape. This splint allows excellent immobilization and does not become deformed by postoperative edema (*6*, Fig. 1).

The stitches are withdrawn within seventy-two hours. The splint is eliminated on the seventh postoperative day.

Terramycin, 1 Gm. daily, is administered during the first seventy-two hours.

The prosthetic structure here described has been applied to 35 patients. In all cases the result is satisfactory.

From the esthetic point of view, I have reached the foreseen result in the models constructed before the operation (Figs. 2, 3 and 4).

From the functional point of view, I have been able to eliminate collapse of the

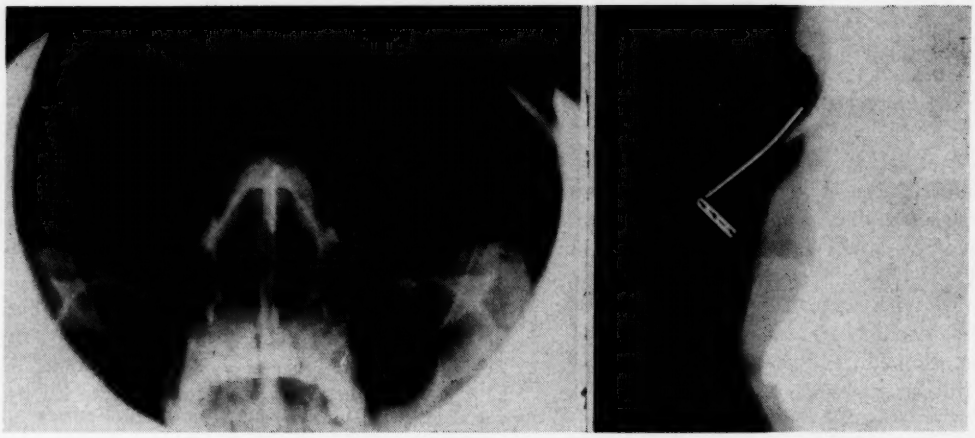

Fig. 2.—Roentgenograms showing prosthesis in position.

Fig. 3.—Results in case of male patient.

Fig. 4.—Results in case of female patient.

alar cartilages, with consequent improvement of the respiratory function.

The first of these patients was operated on three years prior to the time of writing.

SUMMARY

The author describes a two-part acrylic structure to restore the shape in cases of flat nose due to destruction or morphologic collapse.

The two sections of this structure are introduced through a small incision in the columella. The dorsal portion is attached to the nasal spine.

With the use of this device the author has succeeded in giving the nose the necessary projection for a good esthetic result and respiratory function. The incision is occluded in two layers.

Tolerance of the structure has been 100 per cent satisfactory.

RIASSUNTO

L'Autore descrive una protesi acrilica in due pezzi da usare per ridare la forma al naso in caso di naso piatto da distruzione delle ossa.

I due pezzi vengono introdotti attraverso una piccola incisione nella columella. La loro parte dorsale viene fissata alla spina nasale.

Con l'uso di tale procedimento l'Autore ha ottenuto di poter dare al naso la necessaria sporgenza per un buon risultato estetico e per una buona funzione respiratoria. La incisione viene chiusa in due strati.

Nel 100% dei casi la protesi è stata tollerata in maniera soddisfacente.

ZUSAMMENFASSUNG

Der Verfasser beschreibt ein aus zwei Teilen bestehendes Gebilde aus synthetischem Kunststoff (Akryl), das er zur Wiederherstellung der Form der Nase benutzt, wo es entweder durch Zerstörungsprozesse oder durch Zusammenbruch zu einer Abflachung des Organs gekommen ist.

Beide Teile des Gebildes werden durch einen schmalen Einschnitt in den unteren Rand des Nasenseptums eingeführt. Der dorsale Abschnitt wird an der Spina nasalis befestigt.

Es ist dem Verfasser gelungen, mit Hilfe dieser Vorrichtung die Nase genügend vorspringend zu machen, um ein gutes kosmetisches Ergebnis und befriedigende Atmungsfunktion zu erzielen. Der Einschnitt wird in zwei Lagen verschlossen.

Die Widerstandsfähigkeit des Gebildes erwies sich in hundert Prozent als zufriedenstellend.

SUMARIO

O autor descreve uma estrutura acrílica de duas partes para retaurar a forma em casos de nariz chato devido a destruição ou colápso morfológico.

As duas secções dessa estrutura são introduzidas através de uma pequena incisão na columela. A porção dorsal é ligada à espinha nasal.

Com o uso dêsse invento o autor conseguiu dar ao nariz a projeção necessária para um bom resultado estético o função respiratória. A incisão é fechada em duas camadas.

A tolerância à estrutura foi 100 por cento satisfatória.

RÉSUMÉ

L'auteur décrit une structure acrylique en deux parties, utilisée pour la réparation du nez camus.

Les deux parties de cette structure sont introduites par une petite incision de la columelle. La partie dorsale est fixée à l'arête nasale.

Grâce à ce dispositif l'auteur a réussi à donner aux nez traités une bonne apparence esthétique, avec une fonction respiratoire normale. L'incision est fermée en deux plans.

La tolérance de cette structure s'est révélée satisfaisante dans 100% des cas.

Reconstruction of the Labia

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MOST papers dealing with the subject of carcinoma of the vulva describe the radical surgical treatment accepted by most clinics and then present statistics on the survival rates following surgical intervention. Few papers, however, mention the follow-up symptomatic care of the patient, and most of them also fail to mention the distressing symptoms that continue several months or years after the operation.

Actually, carcinoma of the vulva is rare. It has been estimated that of 20 cases of carcinoma of the female genital tract, only 1 is a malignant neoplasm of the vulva.[1] There are several benign lesions of the vulva, however, that frequently require radical vulvectomy—leukoplakia, intractable pruritis and venereal granulomas.

Way[2] stated that an operation for carcinoma of the vulva is incomplete if it is possible to close the wound primarily. He makes no attempt to close the wound postoperatively, but waits for it to "granulate in." Twombly[3] stated that the most difficult problem in radical vulvectomy is to obtain primary wound healing in the groin and that frequently, after primary closure, necrosis of the skin takes place. When this happens the blackened skin area is resected and the granulating area covered with pinch grafts. Cosbie[4] stated that in his practice primary closure is done whenever possible; in circumstances that make it impossible he does not like to resort to skin grafting but allows the wound to granulate and undergo spontaneous reepithelialization. Collins and his collaborators[5] stated that, in treating malignant disease of the vulva, wide excision at the time of operation is imperative, no consideration being given at the time to the manner of closure of the defect created by the operation. He added that the denuded areas that are not subject to primary closure will heal by granulation, or they can be epithelialized by skin grafts. McKelvey[6] stated that in his experience a large number of the wounds broke down as a result of cutaneous necrosis due to excessive tension, and that a large number of procedures have been tried in an attempt to avoid this. Leaving the wound open or applying skin grafts at the original operation made no improvement. In his opinion the wound should be left open; subsequent skin grafting or secondary revision is a satisfactory substitute.

A few surgeons have tried to circumvent the frequent occurrence of slough by advocating reconstructive repair of the large denuded area resulting from radical resection of the vulva. The type of graft most commonly employed, however, is the pinch graft. Occasionally one reads a report describing a successful attempt to close the wound with split thickness graft or flap. Robertson[7] reported 1 case in which, in order to cover the large bare area thus exposed, the adjacent skin was undercut in all directions and, in addition, on the right side a large flap was cut from the thigh and twisted medially so that its upper edge became the right side of the vaginal introitus. Mitchell[8] reported 1 case of radical vulvectomy done for extensive leuko-

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.

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Submitted for publication Sept. 11, 1956.

plakia. He covered the defect remaining, after the skin margins had been undercut and closed as far as possible without tension, with a split thickness skin graft held in place with a large stent dressing. The graft "took" well. Follow-up examinations showed that the graft remained healthy; the area was not tender, and there was no interference with normal coitus.

After a study of the literature on this subject, the impression left with me was that most of the surgeons were quite aware of the radical treatment that is necessary for carcinoma of the vulva. Extensive descriptions were given of the methods used to eradicate the carcinoma and to dissect out the surrounding lymph nodes. Few of these surgeons, however, gave any attention to the large wound left exposed in the perineal region. Most of those who have had the widest experience in this field stated that it is best to leave the wound open and let it granulate and epithelialize spontaneously, while some recommended putting a few small pinch grafts on the open wound, hoping that this would hasten epithelialization. These procedures obviously left a large draining wound that would greatly lengthen convalescence and leave a scarred, contracted perineum that was naturally uncomfortable to the patient.

This failure to graft the open wound initially may be due to an understandable reluctance to prolong an already lengthy operation on a "poor risk" patient, or to the technical difficulties frequently encountered in applying a skin graft on the perineum.

It is common practice nowadays for surgeons to apply skin grafts to the thoracic wall after radical mastectomy if the edges of the skin cannot be brought together without tension. It appears to me that the same reasoning should hold for radical vulvectomy. Mitchell's[8] paper is one of the few in the literature that describes a satisfactory method for proper coverage of the large perineal wound at the time of the original operation. After reading of the hundreds of patients who have undergone radical vulvectomy, I am disturbed to think how some of these women felt after the operation, during convalescence and even after complete epithelialization had finally occurred. Rubin and Lewis[9] reported 1 case of radical vulvectomy in which follow-up examination showed the presence of several severe dense scar formations, especially over the perineal body and the region between the vulvectomy site and the lymph node dissection. They went on to say that, despite the contracted condition of the perineum, the patient gave birth to a child through the vaginal route. This patient must have been well sedated for such a scar-stretching experience. Twombly[3] stated that vul-

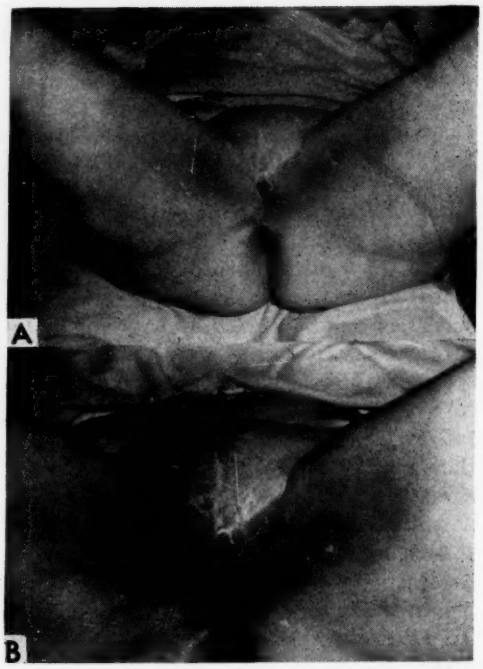

Fig. 1.—*A*, condition of perineum after radical vulvectomy (see text). *B*, condition after release of constricting scar tissue.

vectomy of any sort may be complicated by stenosis of the vagina or by troublesome prolapse when so much perineal support has been removed. He also stated that another common complication of radical vulvectomy is incontinence of urine, due to the pulling downward of the urethra, away from the symphysis, as a result of scar contraction.

REPORT OF CASES

The first case to be reported here is that of a 65-year-old white woman who was first admitted to the hospital on Oct. 27, 1953. On October 28 she underwent radical vulvectomy for a squamous cell carcinoma of the right labium. A wide excision of the entire vulva was carried out. The wound was closed under some tension after relaxing incisions had been made in the midportion of both groins. On November 10 a right radical groin dissection was performed for removal of the superficial and deep inguinal glands. All the wounds healed well, without necrosis of the skin edges. After discharge from the hospital the patient did well as regards healing of the wound, but there was a great deal of discomfort in the perineal region. She stated that she was made extremely nervous by the sensation that the scar around the vagina was "tending to pull the vagina inside out." She was unable to sit up straight, and she was in misery when walking up and down stairs. In addition, when she walked there was a rubbing of the skin just below the vulvar region that caused constant irritation.

I first saw this patient on April 17, 1955 (**Fig. 1**, *A* and *B*), at which time she complained of the aforementioned symptoms and of frequent incontinence of urine. Examination at that time revealed complete absence of the labial folds and the clitoris. Distinct eversion and stenosis of the vagina were present, owing to surrounding scar contraction. In addition, the urethral meatus was pulled downward by the surrounding scars. It was obvious at the time of examination that if the scar contraction were released it would allow the urethra and the vagina to fall back into

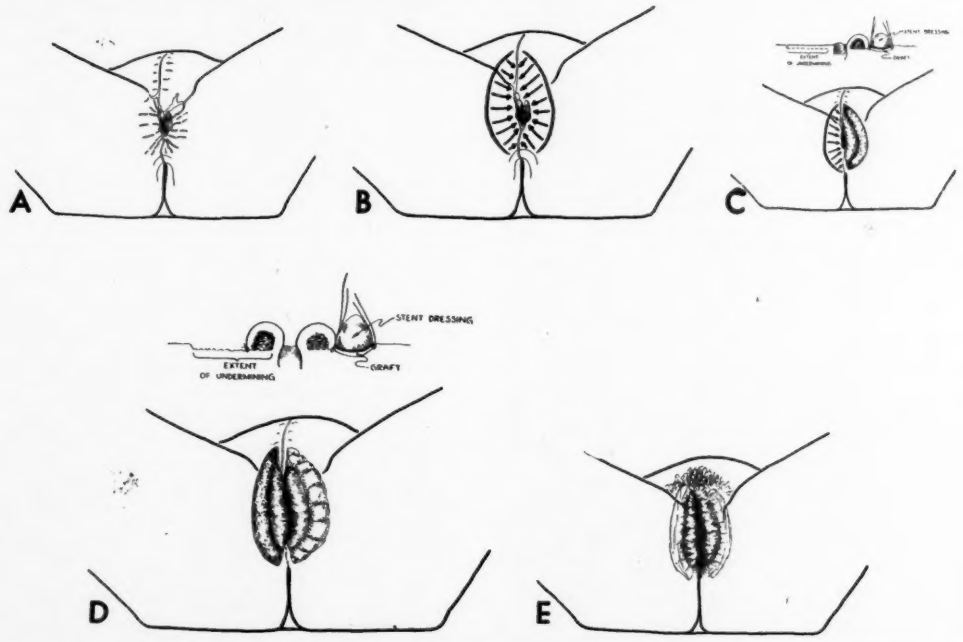

Fig. 2.—*A*, schematic drawing to show contracted scars in the perineum. *B*, site of incisions and extent of undermining. *C*, reconstruction of labia with application of graft and stent dressing. *D*, grafts sutured in place. *E*, reconstructed labial folds.

their normal anatomic positions. It was also the impression that reconstruction of mounds of soft tissue next to the vaginal orifice, resembling labial folds, would give additional protection to the vagina and the urethra and at the same time enable the patient to sit comfortably and to climb stairs.

On April 18, 1955, she was taken to the operating room for release of the perineal scar contractions and reconstruction of the labial folds (Fig. 2, *A* to *E*). Incisions were made on both sides of the vaginal opening on the medial aspects of the thighs, approximately 15 cm. from the vagina. This circular incision measured approximately 20 cm. in length and extended from the mons pubis down to the level of the rectum. A large pedicle flap, based medially, was then elevated. The dissection was carried down close to the urethral and vaginal openings, thereby releasing the scar contraction, which extended radially from the vaginal opening. After release of the scar contraction, the vagina and urethra settled back into their normal positions. A similar procedure was done on each side. The flap was then folded on itself in order to form a raised mound of soft tissue resembling the labia. The flap was sutured down to the subcutaneous tissue with several interrupted No. 4-0 horizontal mattress dermalon sutures. A large open wound along the lateral portion of these flaps over the medial aspect of the thigh was then covered with large split thickness skin grafts taken from both thighs. The grafts were sutured in place with several interrupted and continuous No. 5-0 dermalon sutures. Pressure was maintained over the grafts with a large stent dressing held in position with interrupted No. 3-0 silk sutures.

Fig. 4.—*A*, extensive necrosis of left labium and medial fold. *B*, healthy granulating base.

Fig. 3.—*A*, approximately two months after the operation. *B*, one year after the operation.

After the operation constant drainage with a catheter was established, and the patient was given medication to suppress bowel movements. One week after the operation the dressing was removed, and it was noted that the skin grafts had "taken" most satisfactorily—nearly 100 per cent on the right side and 90 per cent on the left side was noted at the time of the first dressing. The patient was kept in bed for approximately three weeks, until complete healing had taken place. She was discharged from the hospital on May 15.

I checked this patient periodically in my office, and on June 8 it was noted that the whole perineal floor showed softening and there was complete absence of any further scar contraction (Fig. 3 *A*). She stated that she was considerably relieved and that she no longer had the annoying pulling sensation about the vagina. She was no longer incontinent of urine; she was able to sit comfortably and to climb stairways with much more ease. In addition, there was complete absence of irritation of the skin on the thighs when she walked. I last saw her on April 11, 1956, one year after operation (Fig. 3 *B*). Examination revealed moderate flattening of the two reconstructed mounds of soft tissue, but the entire area was soft and there was no recurrence of scar contraction. The patient did complain of some tightness over the anterior right hip joint, at the site of the lymph node dissection. This was due to a vertical contracted scar crossing Poupart's ligament. Since this symptom was rather minimal, however, no further surgical intervention was recommended.

This case demonstrates the condition that exists in the perineal region in many patients who have undergone radical vulvectomy. In this patient the wound in the perineum had healed primarily after radical vulvectomy, and yet considerable scar contraction developed, with accompanying symptoms. I can imagine what the condition of the perineum is when necrosis of the skin develops after vulvectomy and the wound is allowed to heal by granulation. This case is presented in order to describe a simple one-stage procedure for release of scar contractions about the perineum and reconstruction of the labial folds in patients who have annoying symptoms after radical vulvectomy. In selected cases this technic could be employed as a secondary reconstructive procedure when primary skin grafting is contraindicated during the original operation, whether because the patient is classed as a poor risk (usually an elderly patient) or because of the surgeon's reluctance to prolong an already lengthy operation. I am strongly convinced, however, that in many instances and under ideal conditions, proper reconstructive repair during the original operation would obviate this type of secondary procedure.

Fig. 5.—Contracted scarring of left perineal area.

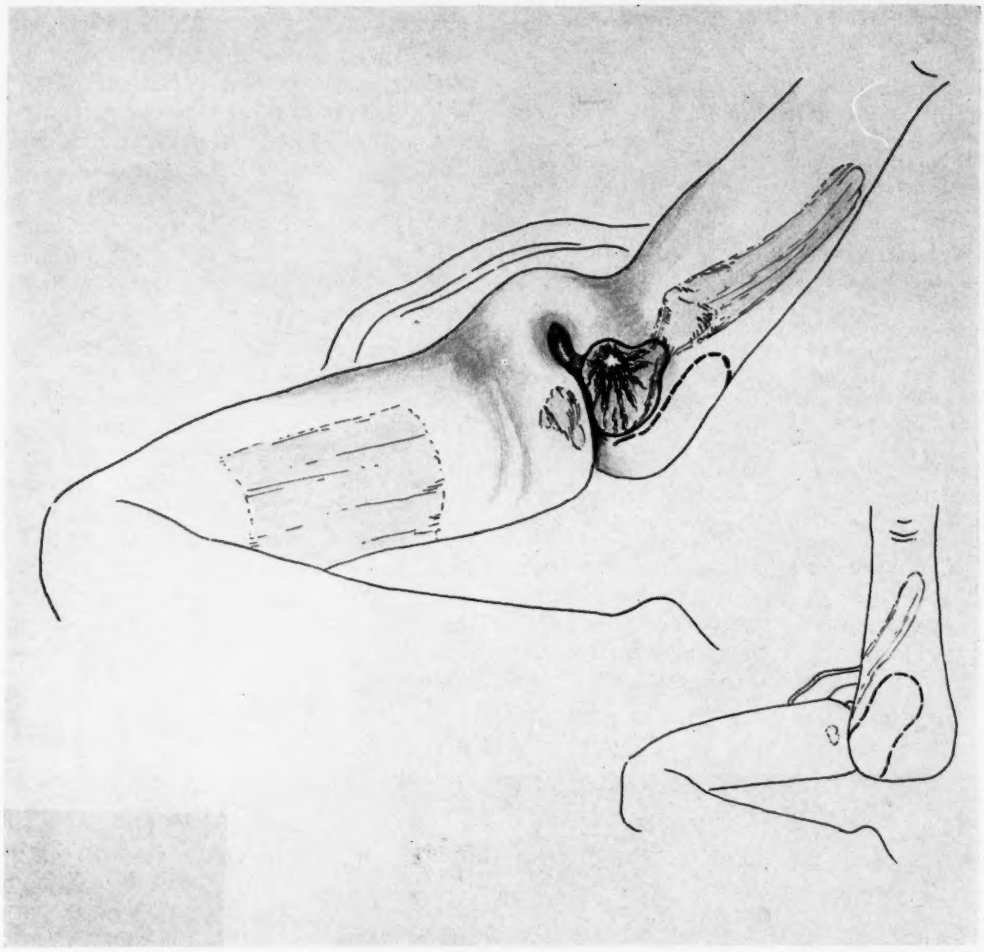

Fig. 6.—Pedicle flap outlined.

The next case is that of a 5-year-old girl with rather extensive necrosis of the left labia, due to having been struck by an automobile. This case is being presented to demonstrate another method of reconstruction of the labial folds. This method can also be used satisfactorily for the same purpose after radical vulvectomy.

A girl 5 years old was struck by an automobile on Jan. 26, 1955. According to witnesses, she was lodged under the vehicle and was released only after the car had been jacked up. There was an extensive crush injury of the soft tissues of the medial aspect of the left thigh and left labia. I first saw this patient on February 7 (Fig. 4 *A*) at which time examination revealed an extensive area of necrosis along the inner medial aspect of the left thigh and perineum. This necrotic area involved the major portion of the left labial region and extended close to the rectum, vagina and urethra. On February 10 débridement of the entire necrotic area was done. After débridement the dressing was changed daily until clean, healthy granulations appeared. On February 17 (Fig. 4 *B*) the granulating area over the thigh and

Fig. 7.—Reconstructed left labial fold.

left labial region was covered with a split thickness skin graft. The graft healed well, and the patient was discharged on March 2.

She was followed in my office, and it was noted that the graft over the left vulval area showed gradual contraction, causing eversion of the vaginal mucosa and a downward lateral pull of the urethral meatus that resulted in frequent incontinence of urine. On July 5 the contracted graft, with the scar on the left vulval area (Fig. 5), was completely excised, allowing the vaginal mucosa and urethra to return to their normal anatomical positions. A large pedicle flap (Fig. 6), based medially, was outlined on the left buttock and the posterior aspect of the left thigh. The flap was elevated and transposed superiorly and medially to cover the large defect on the left vulval region. The area previously occupied by the flap was covered by a split thickness skin graft. Complete healing resulted, and the patient was discharged from the hospital on July 16.

A highly satisfactory result was obtained. The contraction of the left side of the perineum was corrected and fullness of the left labia restored. The vagina and the urethra remained in their normal positions. There was no further incontinence of urine.

I last saw this patient on June 6, 1957 (Fig. 7), at which time the child had no symptoms referable to the perineal region. The area was soft, and there was no evidence of scar contraction or distortion of tissues.

This case demonstrates another simple one-stage procedure for releasing scar contraction in the perineum and replacing soft tissue lost from the labium.

COMMENT AND SUMMARY

Two cases are presented in order to demonstrate two different one-stage operative procedures for releasing scar contractions about the perineum and for reconstructing the labia. The major portion of this paper deals with the difficulties encountered in primary closure of the perineal wound after radical vulvectomy. Obviously the most frequent indication for reconstruction of the labia would be radical resection of the vulva for either a malignant or a benign lesion. The operative technics employed in these 2 cases could be satisfactorily employed as a secondary procedure for patients who have undergone radical vulvectomy and complain of distressing symptoms referable to severe scar contractions in the perineum. It is to be stressed, however, that proper reconstructive procedures done in conjunction with the initial radical vulvectomy would, in many cases, eliminate the need for a secondary plastic operation.

RÉSUMÉ

L'auteur rapporte deux cas, démontrant deux techniques opératoires en un temps pour le soulagement des rétrécissements cicatriciels du périnée et la reconstruction des lèvres. La partie la plus importante de cet article traite des diffcultés de la suture primaire de la plaie périnéale après vulvectomie radicale. Il est clair que l'indication la plus fréquente de reconstruction labiale se présente chez les malades ayant subi une résection radicale de la vulve (tumeur maligne ou bénigne). Les deux techniques opératoires décrites pourraient être appliquées de façon satisfaisante chez des malades ayant subi une vulvectomie radicale et souffrant des symptômes pénibles résultant d'un rétrécissement cicatriciel grave du périnée. Il est à souligner que les techniques appropriées de reconstruction, associées à la vulvectomie radicale initiale, élimineraient dans certains cas la nécessité d'une opération plastique secondaire.

ZUSAMMENFASSUNG

Es wird über zwei Krankheitsfälle berichtet, an denen zwei verschiedene einzeitige operative Verfahren dargestellt werden, die sich zur Beseitigung narbiger Kontrakturen in der Dammgegend und zur Wiederherstellung der Schamlippen eignen. Ein grosser Abschnitt der Arbeit ist der Besprechung der beim primären Verschluss der Dammwunde nach radikaler Resektion der Vulva auftretenden Schwierigkeiten gewidmet. Am häufigsten entsteht eine Indikation zur Wiederherstellung der Schamlippen offenbar bei Patientinnen, die wegen bösartiger oder gutartiger Geschwülste einer radikalen Resektion der Vulva unterzogen werden mussten. Wenn in solchen Fällen Beschwerden infolge schwerer Narbenkontrakturen des Dammes auftreten, lassen sich beide in der Arbeit beschriebenen Techniken mit gleichmässig zufriedenstellendem Erfolg anwenden. Es muss allerdings hervorgehoben werden, dass geeignete plastische Massnahmen in Verbindung mit der ursprünglichen radikalen Resektion der Vulva in vielen Fällen die Notwendigkeit späterer plastischer Operationen überhaupt auszuschalten vermögen.

RESUMEN

Se reportan dos casos para demostrar dos diferentes procedimientos operatorios de un tiempo para liberar las contracturas cicatriciales alrededor del perineo y reconstruir los labios. La mayor parte del artículo trata de las dificultades encontradas en el cierre primario de la herida perineal después de vulvectomía radical. Obviamente, el caso en que más frecuentemente está indicada la reconstrucciòn de los labios es en pacientes que han sido sometidas a resección radical de la vulva ya sea por tumores malignos ó benignos.

Las técnicas operatorias descritas para cada un serán satisfactoriamente empleadas como un procedimiento secundario en los casos de las pacientes que han sido sometidas a vulvectomía radical y que se quejan de síntomas severos como resultado de severas contracturas cicatriciales en el perineo. Hay que enfatizar, sin embargo, que los procedimientos reconstructores propiamente, en conjunción con la vulvectomía radical inicial, eliminarían en muchos casos la necesidad de una operacion plástica secundaria de cualquier clase.

SUMARIO

Apresenta dois casos para ilustrar dois métodos diferentes, em estágio único, na correção de retrações cicatriciais do perineo com reconstrução da vulva. Na mior parte do trabalho o A. estabelece as difi-

culdade encontradas para a síntese de ferida perineal após a vulvectomia total, especialmente indicada para tratamento dos tumores malignos e benignos. As técnicas operatorias descritas tem indicação nos casos de sequelas da vulvectomia comportando também a associação da operação radical e do emprego imediato dos métodos de reparação citados pelo A. Dessa maneira se elimina a necessidade de tratamento reparador em estágio posterior.

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Theories of the scientific method which try to explain the establishment of scientific truth by any purely objective procedure are doomed to failure. Any process of inquiry unguided by intellectual passions would inevitably spread out into a desert of trivialities. Our vision of reality, to which our sense of scientific beauty responds must suggest to us the kind of questions that it should be reasonable and interesting to explore. It should recommend the kind of conceptions and empirical relations that are intrinsically plausible and which should therefore be upheld, even when some evidence seems to contradict them; and tell us also, on the other hand, what empirical connections to reject as specious, even though there is evidence for them and we may as yet be unable to account for this evidence on any other assumptions.

—Polanyi

Acne

Pathologic and Clinical Observations

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MANY articles have appeared on the treatment of acne. It remains a disease which, in its active phase, is treated in a protean manner, with varied and questionably beneficial results. The disease runs its course, frequently disfiguring the victim and occasionally warping his or her personality. As a surgical group, this department has long been interested in the restoration of the facial appearance and thereby the personal and social rehabilitation of these unfortunate individuals. The singularly outstanding progress made to date in treating this disease is that by Iverson[1] in surgically sanding or planing the skin. This surgical technic has been described by Iverson and modified by others.[2]

Clinical Observations. — In evaluating faces pitted and scarred by acne one encounters various types. Some have sharply pitted scars of the pock type and others

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Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.

Submitted for publication Sept. 23, 1956.

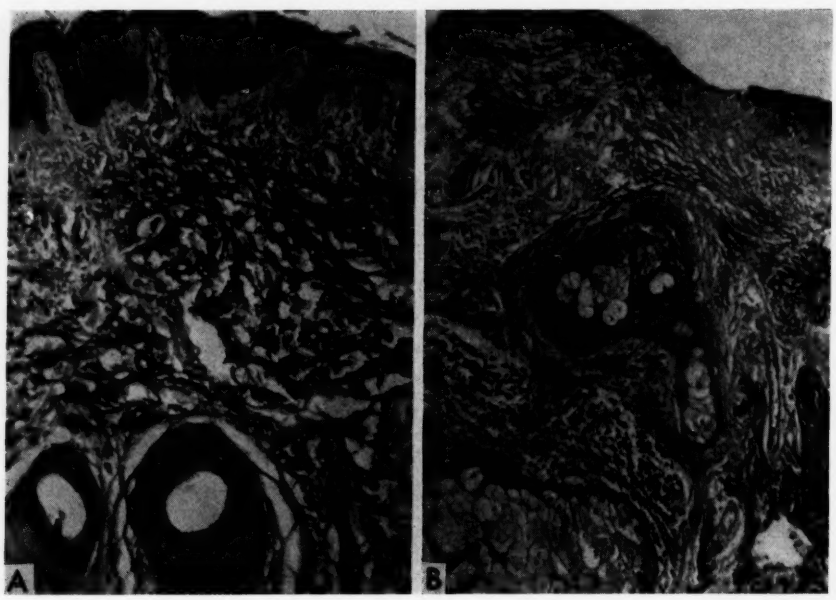

Fig. 1.—*A*, normal preauricular skin showing normal elastic tissue. *B*, acne vulgaris (preauricular skin). Note decrease and fragmentation in elastic tissue, abraded surface of skin, round cell infiltration and pilosebaceous glands with plugging.

Fig. 2.—*A*, acne scarring (preoperative). Cutaneous tension poor. *B*, acne scarring (postoperative). Note surgical abrasion and meloplasty.

Fig. 3.—*A*, acne scarring (preoperative). Cutaneous tension poor; scars broad and flat. *B*, postoperative appearance (meloplasty only).

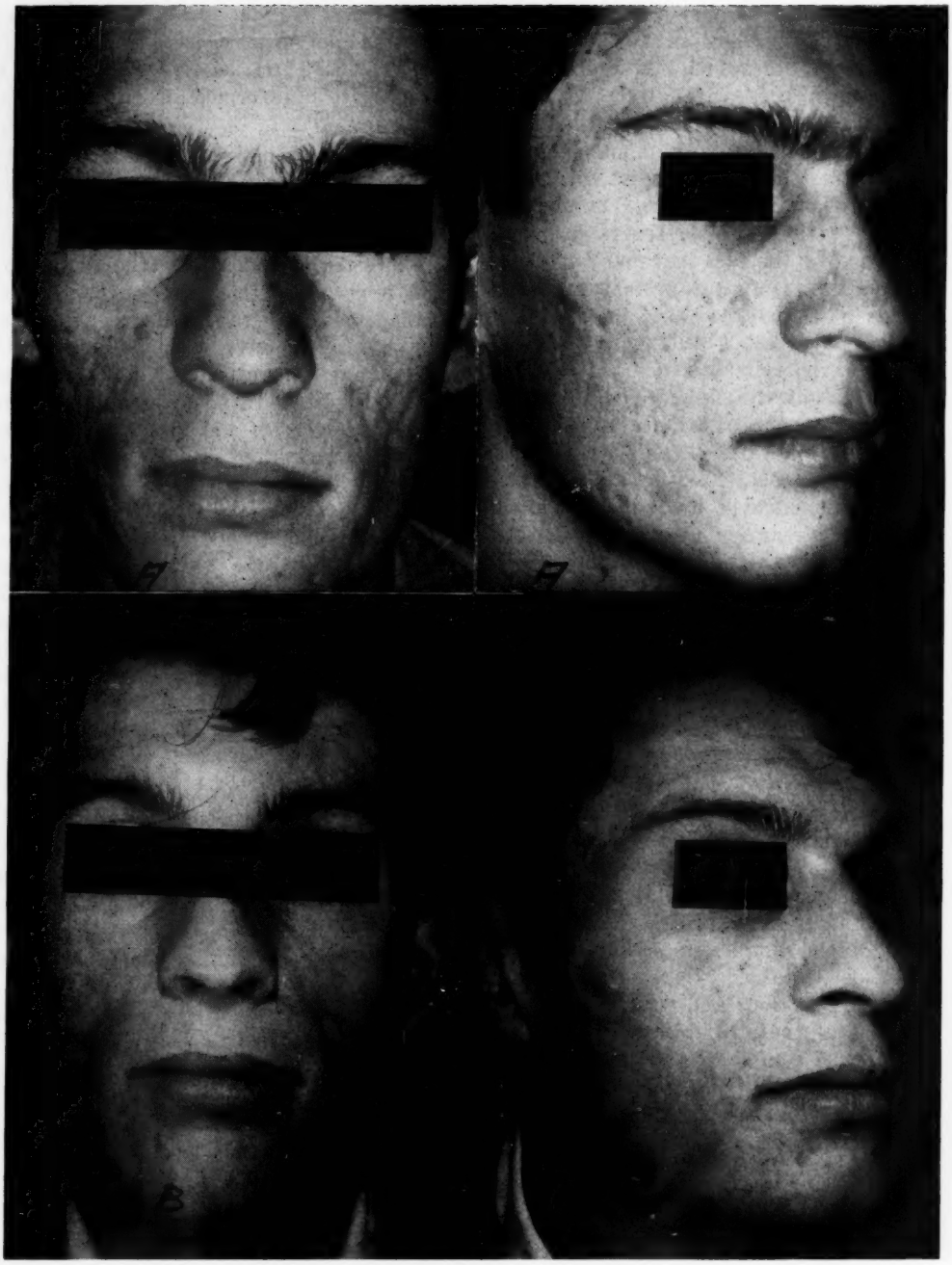

Fig. 4.—*A*, acne scarring (preoperative). Cutaneous tension good and scars sharply pitted. *B*, postoperative appearance (surgical abrasion only).

have broad, flat, shallow ones. There are some with seemingly normal cutaneous tension and others with a prematurely aged appearance, a condition to which acne scars contribute a great deal. The last-mentioned type, with its management, is of interest in this presentation.

After examining a large number of patients with post-acne scarring, one is impressed by the fact that many of them, though not all, appear prematurely aged and wrinkled. By handling the skin it is possible to detect a feeling of looseness and a decrease in elasticity. It can also be noted that the skin seems to fall or wrinkle into the pitted scars, especially the broad, flat variety. This wrinkling is particularly accentuated in smiling and is easily demonstrated by pulling the skin from the preauricular area toward the oral commissure. Conversely, by tensing the facial skin toward the ear, as in evaluating a candidate for a meloplasty, one notes a great decrease in the pitted and wrinkled appearance. Age appears to have little relation to these appearances; for example, they may be seen in a woman who, chronologically, is in her twenties, however much older in appearance.

Pathologic Observations. — Samples of normal skin were obtained from the preauricular area of a subject of comparable age to subjects with acne scarring who were undergoing surgical abrasion and from whom samples of preauricular skin were also obtained. Routine hemotoxylin and eosin sections and elastic tissue stain sections of these samples were made. In the normal sample, the routine characteristics of normal skin, associated with an expected amount of elastic tissue, were observed (Fig. 1*A*). In the samples of skin affected with acne, the usual follicular plugs with perifollicular vascular and lymphocytic infiltration and the expected fibrosis in the pitted areas were noted. In addition, however, the elastic tissue did not appear to be present in normal amounts but was decreased and fragmented (Fig. 1*B*), as was observed by a pathologist uninformed of our interests.

Treatment.—In view of the clinical observation of premature wrinkling in some cases of acne scarring and the pathologic evidence of a decrease of varying degrees of the elastic fiber in sections of skin from the affected areas, it was thought preferable to respect both factors in the surgical management of the problem. Surgical abrasion, therefore, was combined with face lifting in many patients with this disease (Fig. 2). In some instances, when the scars were of the broad, flat variety and the wrinkling seemed pronounced, surgical abrasion was deleted and meloplasty only was done (Fig. 3). In a good proportion of all patients with acne scarring, however, the tension of the skin approximated a normal state and only abrasive therapy was done (Fig. 4). Some surgeons may be managing these problems in a similar fashion. A brief review of the literature, however, has not revealed such a report.

SUMMARY

Patients with post-acne scarring may have premature wrinkling of the facial skin into the pitted areas. In such cases, a decrease in the elastic fiber of the skin has been noted. The treatment preferred in these cases was surgical abrasion and meloplasty and, in a few instances, meloplasty alone. It is appreciated that the premature wrinkling may be due to fibrosis in the scarred areas as well as to a decrease in the elastic tissue.

RESUMEN

Los pacientes con cicatrices post-acné pueden tener arrugas prematuras en la

piel de la cara en las áreas afectadas. En tales casos, escasez de la fibra elástica de la piel se ha notado. El tratamiento preferido en esos casos fué abrasión quirúrgica y meloplastía y en pocas ocasiones, solo meloplastía. Se cree que los arrugas prematuras pueden deberse a fibrosis en las áreas cicatrizadas tanto como a la escasez del tejido elástico.

RIASSUNTO

Nei pazienti con cicatrici da acne è stata notata una precoce ruosità della cute del viso nelle zone colpite. In tali sedi vi sarebbe una diminuzione delle fibre elastiche cutanee. La cura migliore è la abrasione chirurgica associata a meloplastica o, talvolta, la semplice meloplastica.

Tale precoce rugosità potrebbe essere causata, oltre che dalla diminuzione del tessuto elastico anche da una fibrosi della cute nelle zone cicatriziali.

RÉSUMÉ

Les malades atteints de cicatrices acnéiques peuvent présenter des rides faciales prématurées dans les régions marquées. Dans ces cas une diminution de la fibre élastique de la peau a été constatée. Le traitement préféré de l'auteur est l'abrasion et la méloplastie chirurgicales, parfois la méloplastie seule. Les rides prématurées peuvent être dues à une fibrose des régions cicatricielles, ainsi qu'à une diminution des fibres élastiques.

ZUSAMMENFASSUNG

Bei Kranken mit Aknenarben kann es zu vorzeitiger Faltenentwicklung der Gesichtshaut in die narbigen Gebiete hinein kommen. In solchen Fällen wird ein Verlust der Haut an elastischen Fasern beobachtet. Die beliebteste Behandlung bestand in chirurgischer Abschabung und Wangenplastik und in manchen Fällen ausschliesslich in Wangenplastik. Die Tatsache wird anerkannt, dass die frühzeitige Faltenbildung ebensowohl durch Fibrose in den narbigen Gebieten zustande kommen kann als durch Verlust elastischen Gewebes.

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The everlasting pushing and striving of blinded mortals in order to gain so and so much, to secure some honor or other, to do a service to this or that great personage—this is generally fatal to our welfare, this is a common cause of young people ageing and dying before their time.

—*Lewis*

Critical Use of Skin Grafts

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IT was not many years ago that the grafting of skin in itself was of sufficient significance to make the healed end result seem satisfactory. This is not surprising when one recalls that the free grafting of skin was first done successfully in the human being less than a century ago (Reverdin, 1869; Ollier, 1872, Thiersch, 1874, and Wolfe, 1875) and that tubed pedicles were first reported by Filatoff in 1917 and Gilles in 1920. Technical advances and the increased skill of more surgeons have developed the use of skin grafts since the First World War, especially in the past twenty years. Plastic surgeons have pointed the way and have increased the knowledge, so that some skin grafting is now done by many competent surgeons. It is only natural, therefore, that a more critical appraisal of the choice of grafts, the methods and the results has evolved.

The purpose of this paper is to present some opinions based on clinical observations, as to the selection by a rationale, I have found useful. The technical aspects of applications will be omitted. A simple classification of grafts which has been used is as follows:

Pedicle grafts
- Local flaps
- Distant flaps

Tubed pedicle grafts
- Free skin grafts
- Reverdin grafts
- Small deep pinch grafts
- Postage stamp and strip grafts
- Thin split-thickness or Ollier-Thiersch grafts
- Thick split-thickness grafts
- Full-thickness graft of Wolfe

The ideal graft replaces exactly the missing part. The color, the thickness, the vascularity, the nerve supply, the pigmentation, the texture, the epithelial elements (hair) and the subcutaneous tissues are characteristics to be considered. Because these characteristics are frequently best matched by adjacent skin, usually a flap or graft from a distant part is not the best. This fact is recognized in the use of multiple-stage excision, advancement flaps, rotation flaps and especially in simple undermining and closure when possible.

Determining factors in the choice of grafts are the availability of the graft, the expediency of the surgical procedure and the needs of the patient or part. There must also be an operating surgeon capable of executing the procedures selected and a patient who is willing to withstand the surgical treatment required. If the graft has been selected with care and the requirements of the patient and the recipient site have been evaluated carefully, the best result frequently is obtained by using the simplest and most direct method. In some cases the proper graft is not available, or a graft with the ideal characteristics may be impossible to obtain; for instance, the face may be completely burned, and the free graft may fail to reestablish a complete nerve supply. In general, there are two reasons for the grafting of skin. The first and most important is to restore function; the second is to restore the appearance of the part. A perfect functional

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.
Submitted for publication Jan. 10, 1957.

result with less than the best esthetic result is more desirable than a pleasing cosmetic result without function, yet the goal of the critical surgeon is to provide both as far as is possible in the existing circumstances.

Hair growing in a graft may be advantageous if it is advanced from the neck onto the cheek of a man. Hair is the essential element in the free full-thickness graft from the scalp to replace the eyebrow; yet it is not desirable in a palm or on a woman's face. To obtain hair for a man's upper lip, pedicle grafts have been swung from the scalp, producing ludicrous results, because the thick, rigid scalp is placed on a part that is normally mobile.

Judgment is required to determine whether a graft is necessary at all. Skill is useful in the avoidance of grafting if a better result may be obtained thereby. It is not good judgment to place a graft of white abdominal skin on a ruddy-faced patient who has had second-degree and patchy third-degree burns that will heal, without excess scar or contracture, in a time only a little longer than a "rule of thumb" dictates. It is not skillful to graft skin, with difficulty, over an electrical burn that may be excised and the defect closed. Occasionally a deep defect in an extremity, which can be filled only with great difficulty, may eventually be ready for a simpler procedure if one waits judiciously for normal granulation and cicatrization.

Large defects and donor areas on the abdomen may be closed without grafting by undermining, incising to release the superficial fascia and closing under maximum tension with buried subcuticular sutures. On the other hand, defects of the fingers may require grafts because there is little skin available, or grafts may prevent lines of incision from being placed vertically on the fingers or crossing flexion creases.

Large defects may be removed and covered in stages by gradual partial excision and closure with maximum skin tension. The surrounding skin relaxes, closure is easier, and the subsequent relaxation of the skin is greater if the pull is perpendicular rather than parallel to Langer's lines of skin tension. The resulting scar also spreads less.

A graft may not be necessary if the surgeon is familiar with the Z plasty, which is especially useful in the treatment of contractures. It consists of two or a series of interdigitating triangular rotation flaps that release pull or contracture in one direction by utilizing tissue in the other direction. It may be used to change the direction of the margins of the area to be grafted, so as to prevent contracture at the margin without sacrificing normal skin (i.e., webbed fingers).

Selected, less severe skin and scar contractures may be corrected by traction alone, without skin grafting.

The pedicle graft is used for replacing both skin and subcutaneous tissue. It may be required to cover bone, joints or tendons, or it may be used to restore a loss of contour or padding, or to restore circulation to a part where the blood supply is insufficient to support a free graft (e.g., irradiation ulcer), or when later operation on underlying structures will be required. Mobile structures, such as the tendons in the legs, are better covered by a flap than by an adherent free graft. When the nerve supply to a part (finger) is critical, an appropriate pedicle transferred with its nerves intact gives a better result. Pedicles may be used only to provide subcutaneous tissue and derma, or subcutaneous tissue only, to improve contour; the superficial skin of the pedicle may later be replaced by advancing more desirable adjacent skin or by free grafts of skin that has better color and texture than had the original pedicle.

Direct and open flaps are more rapidly

grafted to a distant part than are tubed pedicles, i.e., cross-leg, abdomen-to-hand and arm-to-face. Tubes may require one or more operations to prepare them to be transferred. Expedition may be important, so that judgment is required to determine whether the end result will be better if rapidly accomplished or more critically done. It is preferable not to use cross-leg flaps for women, because of the resulting scar and the defect on the donor leg. The arm flap to the face may take fewer stages, but it may provide skin of less desirable color and texture than that obtained from the neck or cheek by multiple-stage excision with advanced or rotation flaps.

A pedicle that is attached to scar tissue or to an irradiated area and not attached at its margins to normal skin and subcutaneous tissue may "roll up" on itself, have a permanently impaired blood supply and provide a useless and unpleasing result.

Double pedicle and rotation flaps are useful for closing defects in which a flap is required or the donor area may be grafted or closed. The double pedicle graft is useful to cover the exposed tibia. The donor site, which is over soft tissue, is free grafted. An example of the rotation flap is a flap from the forehead to the nose. The donor area on the forehead can frequently be closed.

Free skin grafts are used to replace losses too large or too deep to be covered by epithelization or when closure is not possible. They are most useful for treating burns and extensive wounds. They provide temporary skin dressings and replace scars when subcutaneous tissue is not required. Usually a free split-thickness skin graft is applied as a procedure of necessity or expediency, although there are instances in which it will give the best result. The split-thickness skin graft contracts postoperatively, may become abnormally pigmented and may wrinkle. It is used for extensive wounds because it is available in large quantities. The result is a patch that may be adequate, giving the best result possible. It is frequently second or third choice but must be considered first for extensive burns on the dorsum of the hand if the tendons are not destroyed.

SUMMARY

After a brief resume of the history of skin grafting, the author mentions the various types of cutaneous graft in current use, emphasizing the fact that the ideal graft is the one that most nearly approximates the normal appearance and structure of the part to be repaired.

He also points out that careful judgment is needed to determine whether grafting is actually necessary, since many injuries can be handled successfully without it. A meticulous study of the individual patient is also needed, since important psychic considerations are frequently involved.

RIASSUNTO

Dopo una breve esposizione della storia dei trapianti cutanei, l'autore ne elenca i vari tipi sottolineando il concetto che il trapianto ideale è quello che più si avvicina, per ogni carattere, alla porzione di cute che deve sostituire.

Un altro punto importante da stabilire è se il trapianto sia realmente necessario, dacchè molte lesioni possono essere benissimo trattate senza di esso. E' necessario uno studio meticoloso di ogni singolo paziente anche dal punto di vista psicologico.

RÉSUMÉ

Après un bref résumé de l'historique de la greffe épidermique, l'auteur mentionne les divers types de greffe cutanées d'usage

courant, soulignant le fait que la greffe idéale est celle qui reproduit le plus fidèlement l'aspect et la structure physiologiques.

Il faut faire preuve de la plus grande prudence pour décider de la nécessité d'une greffe, car bien des lésions peuvent être traitées avec succès par d'autres méthodes. Une étude approfondie de chaque cas est également nécessaire; souvent, en effet, l'on doit tenir compte d'importantes considérations psychologiques.

RESUMEN

Después de un breve resumen de la historia de los injertos de piel, el autor menciona los varios tipos de injertos cutáneos en uso corriente, enfatizando el hecho de que el injerto ideal es el que más se aproxima en apariencia y estructura a la parte que se va a reparar.

También señala que se necesita un criterio cuidadoso para determinar si el injerto es realmente necesario ya que muchas lesiones pueden, manejarse con éxito sin usarlos. Tambien se necesita un estudio cuidadoso del paciente individualmente ya que frecuentemente se encuentran importantes consideraciones de índole psíquica.

ZUSAMMENFASSUNG

Nach einem kurzen Überblick über die Geschichte der Hautplastik erwähnt der Verfasser die verschiedenen gegenwärtig gebräuchlichen Arten von Hauttransplantaten und hebt hervor, dass das ideale Transplantat dasjenige ist, das der normalen Erscheinung und Struktur des zu ersetzenden Teiles am nächsten kommt.

Er weist ferner darauf hin, dass sorgfältig entschieden werden muss, ob eine Transplantation wirklich nötig ist, da viele Verletzungen auch ohne eine solche erfolgreich behandelt werden können. Weiterhin ist es notwendig, sorgfältig auf die Gesamtpersönlichkeit des Kranken einzugehen, da psychologische Faktoren oft eine bedeutende Rolle spielen.

Without a scale of interest and plausibility based on vision of reality nothing can be discovered that is of value to science; and only our sense of scientific beauty, responding to the evidence of our senses, can evoke this vision. Such is the *selective* function of scientific passion.

—*Polyani*

Iliac Bone Graft for Correction of Maxillary Retrusion in Cases of Cleft Palate

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OVER the past fifteen years, refinement in surgical technic and better understanding of the growth of the facial skeleton has led to superior end results in the surgical treatment of the patient with harelip and cleft palate. Unfortunately, during this fifteen-year period, not all such patients have received the benefit of this scientific knowledge. Today, therefore, a small number of them present severe facial disfigurement because of injudicious surgical procedures carried out in the repair of either a bilateral harelip or a cleft palate. It is our intention here to present a surgical technic by which a facial contour more nearly normal may be restored to such patients, most of whom have undergone an operation on the premaxilla early in life.

The objectives of any surgical procedure for the repair of a cleft palate should be the achievement of normal speech and the conversion of one large common cavity into two normal anatomic cavities. Recent research reveals that certain operations for the repair of cleft palate may produce external deformities; consequently, the ideal procedure should be so conceived as to permit allowance for normal development of the facial skeleton. It must not interfere with the growth of the facial bones.

In the early twentieth century, surgeons performing this type of operation were concerned primarily with the attainment of normal speech. For this reason, the literature of that era is replete with reference to pharyngoplasties, pushback operations and pushback operations combined with the use of a pharyngeal flap.[1] The classic operation of von Langenbeck has been criticized because it often fails to produce a palate of sufficient length to permit velopharyngeal closure. It is claimed that the raw nasal surface of the palatal flaps invites infection and the formation of hematoma; hence, a short, scarred, immobile palate results. Moreover, it is claimed that this operation may permit damage of the nerve supply of the tensor palati, resulting in paralysis of this muscle.[2]

The operations of Veau and Wardill were planned to eliminate shortening of the palate in an AP direction.[3] Dorrance,[3] and later Baxter,[4] recommended the use of a free skin graft to the nasal surface of the palatal flaps to avoid this undesirable contracting effect. Conway[5] advocated removal of the posterior portion of the bony palatine canal to allow more successful retrodisplacement of the palate. Advocates of the Warren Davis osteoplastic technic[6] have insisted that this operation has greater respect for both nerves and blood vessels and results in better speech. The aforementioned comments are presented to show that the trend in surgical treatment of the cleft palate over the past fifteen years has been dominated by the desire for achievement of normal speech.

Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 10-13, 1956.
Submitted for publication Jan. 10, 1957.

More recently, attention has been focused on the effect of modern surgical procedures on the growth of the facial skeleton.[7] Knowledge of the normal growth of the maxillae has been obtained by studies utilizing the injection of Alizarin red into monkeys and by serial cephalometric studies.[8] Slaughter and Brody[9] stated that growth of the facial bones takes place principally at the following sutures: frontomaxillary, zygomaticomaxillary, zygomaticotemporal, pterygomaxillary (tuberosity), and zygomaticofrontal. These sutures remain active until adulthood, but generalized surface growth ceases, for the most part, by the fifth year of life. Being keenly aware of the growth behavior pattern of the facial skeleton, many surgeons are now reluctant to perform an operation that requires extensive undermining in the region of the hard palate before the fifth year of life.[10] In spite of the forewarning implicit in this information, one encounters many patients who have undergone the conventional operations for closure of the hard palate and who present no evidence of underdevelopment of the face. This is a fact that should be given serious consideration before abandoning the standard operative procedures employed for this purpose.[11] It would appear that, in cases of complete cleft palate, a successful closure carried out in one procedure is more important than the harm that might arise from an operative procedure carried out before the patient is 5 years old. In our experience, underdevelopment of the maxillae is more common in cases in which repeated operations have been performed in the region of the hard palate. In our opinion, however, any operation performed on the premaxilla early in life invariably results in facial disfigurement.

Reference to the surgical literature discloses considerable disagreement with regard to proper handling of the premaxilla.[12] In cases of uncomplicated bilateral cleft lip (when the premaxilla is in a more or less normal position), opinion is undivided; the premaxilla should be left undisturbed. Bilateral lip repair[13] in these cases restores the continuity of a continuous muscle band whose anterior component is the orbicularis oris and whose posterior component comprises the buccinator and superior constrictor of the pharynx. The molding effect of this muscle band and the tongue contributes to normal development of the upper dental arch.

In complicated cases of bilateral harelip, proper treatment pivots upon the question whether more harm comes from removal of the extremely anteverted premaxilla, with its attendant complications of alveolar collapse and malocclusion, or the good that may come from retention of the premaxilla.[14] It is our opinion that in all cases of bilateral harelip and cleft palate the premaxilla should be spared. Any operation on this structure results in disfigurement of the face. In complicated cases of bilateral harelip, the use of proper orthodontic appliances prevents the severe complication of alveolar collapse.[15]

The two cases here reported have several features in common. Both patients underwent resection of the premaxilla early in life. Both present evidence of extreme underdevelopment of the maxillae, with retrusion of the central third of the face. Both show extreme collapse of the alveolar processes. Both have required intensive orthodontic treatment, and reference to the accompanying photographs will indicate the considerable improvement attained in the profile of each patient by simple construction of an orthodontic appliance so designed as to exert a forward thrust upon the upper lip. Additional need for improvement in facial contour in these 2 cases initiated a clinical investigation into the merits of transplantation of iliac

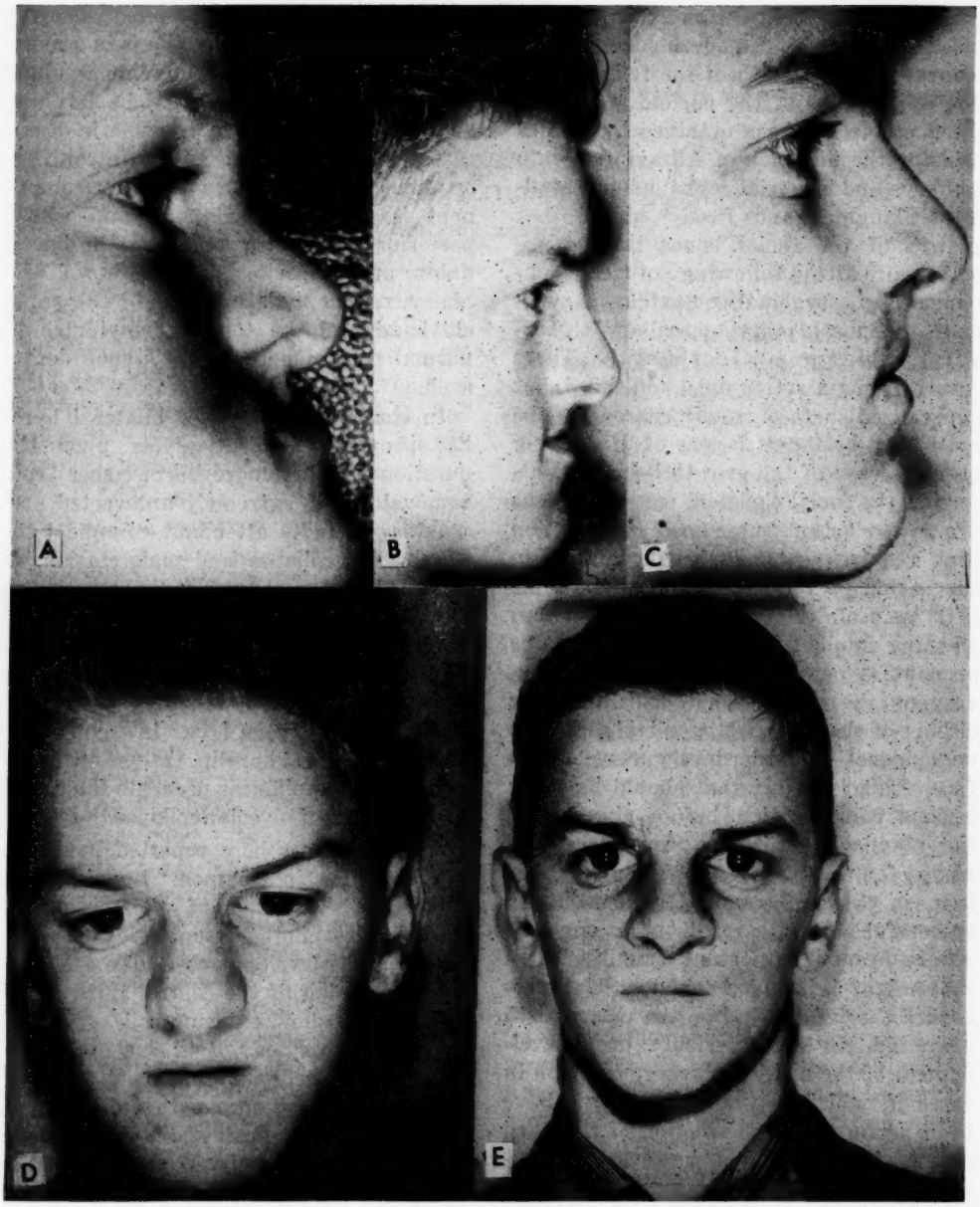

Fig. 1 (*Case 1*).—*A*, appearance of patient when first examined at clinic. Note retrusion of central third of face and prognathism. *B* and *D*, lateral and full-face views of the patient after extensive orthodontic treatment and fitting of orthodontic appliance. Note degree of improvement achieved in contour of upper lip with an orthodontic appliance. *C* and *E*, lateral and full-face views taken two months after transplantation of an iliac bone graft as described in text. Note degree of further improvement in contour of entire central third of face. This improvement can be attributed solely to the bone graft, as an orthodontic appliance is not in place in this particular case.

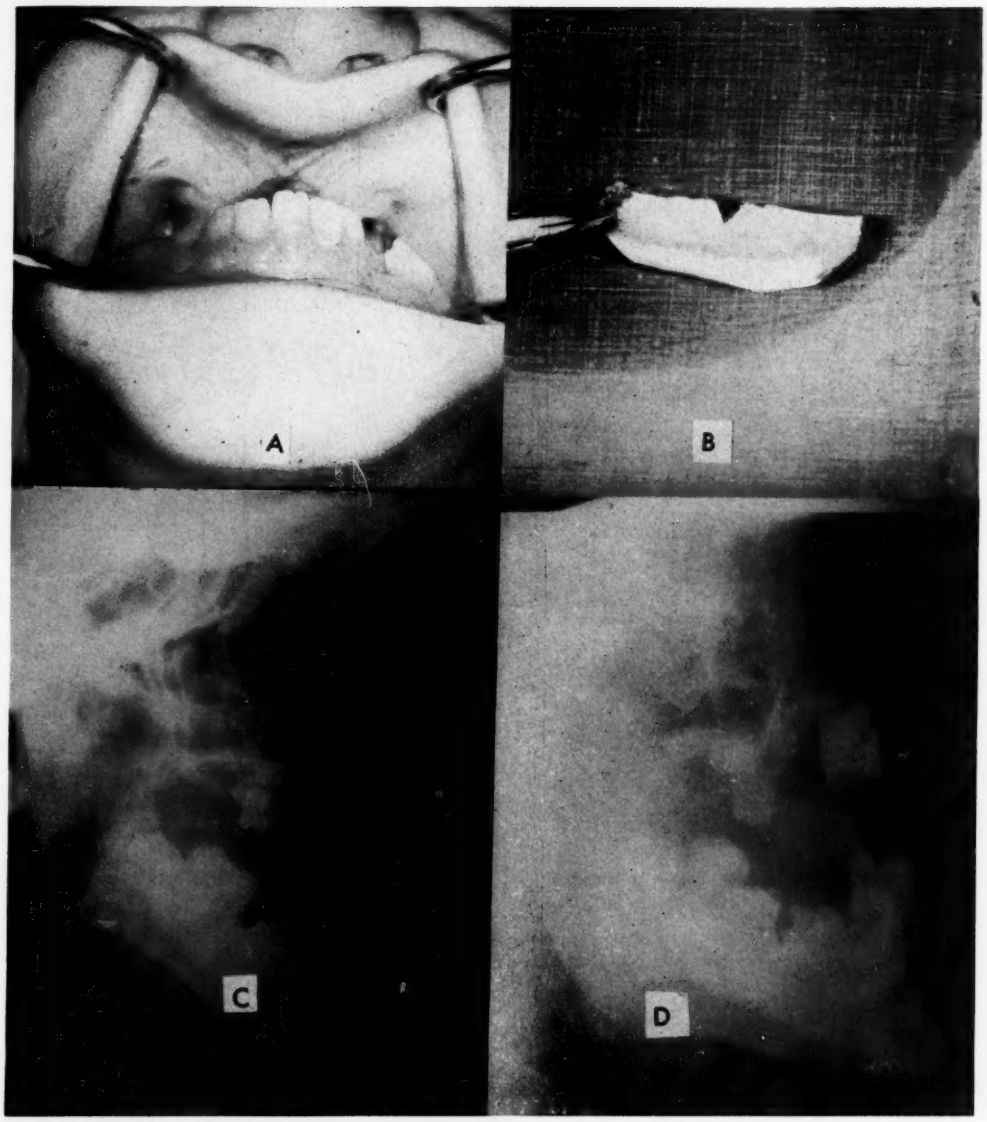

Fig. 2 (*Case 1*).—*A*, appearance of upper dental arch prior to transplantation of bone graft. Note extreme degree of collapse of alveolar processes, with narrowing of the upper dental arch not only in its anterior but in its posterior portion. *B*, bone graft prior to transplantation. Note shape, size and contour. Indentation on posterior surface of bone graft was made to facilitate approximation of graft upon nasal spine. *C* and *D*, roentgenograms taken immediately before and two weeks after transplantation. On preoperative film, note extreme underdevelopment of maxilla with resultant retrusion of central third of face. Also note prognathism.

bone to this area. The results in the 2 cases have been gratifying and necessitate a further investigation of the operative procedure.

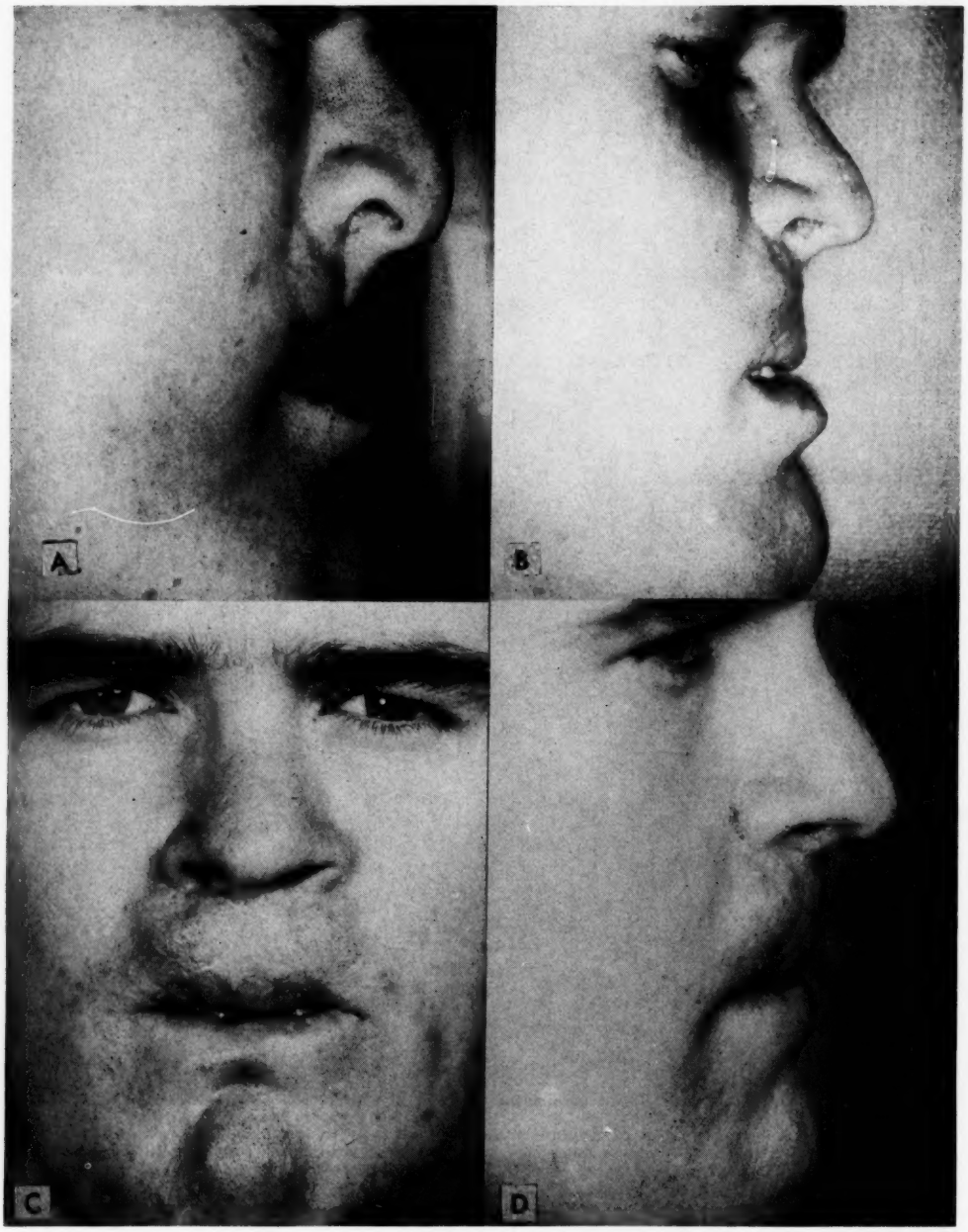

Fig. 3 (*Case 2*).—*A*, profile view of patient when first examined in clinic. Note nasal deformity, scarring of upper lip and retrusion of central third of face. In this case, premaxilla was removed during primary repair of lip. At a later date, skin of the prolabium was utilized to reconstruct columella. *B*, appearance of patient after rhinoplasty, revision of lip scars and fitting with an orthodontic appliance to restore contour to upper lip. *C* and *D*, full-face and lateral views of patient three months after transplantation of bone graft. Note further improvement in contour.

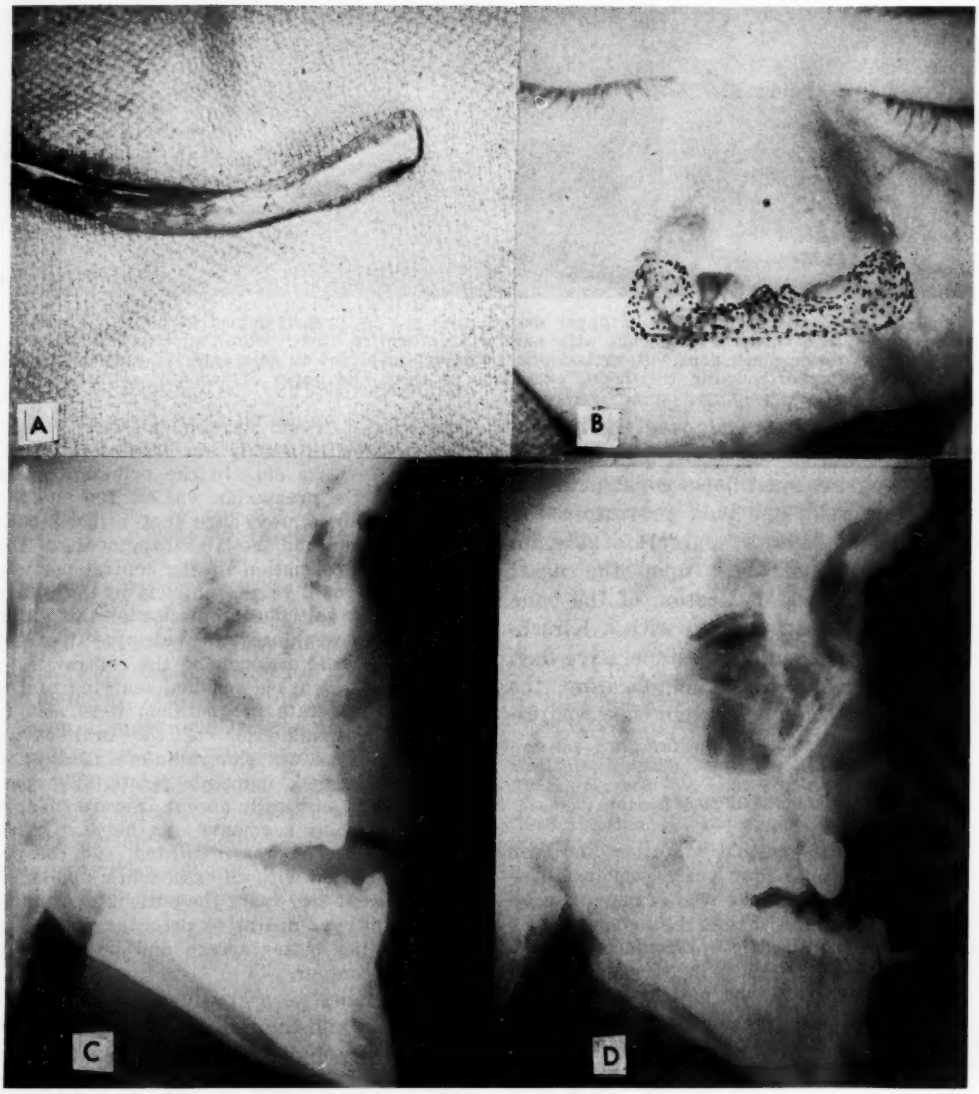

Fig. 4 (*Case 2*).—*A*, bone graft employed in case of this patient. *B*, area of stippling, representing extent of undermining carried out. Incision employed in surgical approach to area can be visualized. *C* and *D*, preoperative and postoperative roentgenograms of patient. Note again the extreme underdevelopment and retrusion of the maxilla, with accompanying prognathism.

The operation is carried out with endotracheal anesthesia. The graft is taken from the iliac crest in the conventional manner. The surgical approach to the upper lip is through a curvilinear incision along the base of either the left or the right ala. Undermining is carried out along the floor of the nose, with exposure

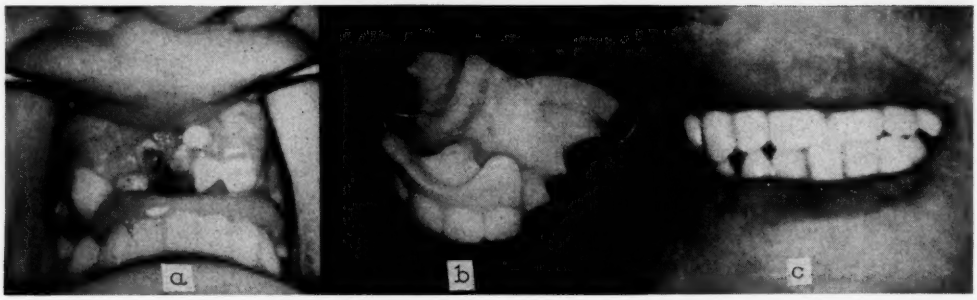

Fig. 5 (*Case 2*).—*A*, appearance of upper dental arch when first examined at clinic. There is marked collapse of alveolar segments with narrowing of entire upper dental arch, in both lateral and anteroposterior dimensions. *B*, orthodontic appliance employed in this case. *C*, appearance of patient after orthodontic treatment, extraction of teeth and upper orthodontic appliance.

of the nasal spine, and over the lateral aspects of the cheeks (Case 2, Fig. 2*B*). The bone graft must be so constructed as to provide sufficient bulk to restore the normal facial contour, and, preferably, its midportion should rest upon the nasal spine. In Case 1, dislocation of the bone graft necessitated pinning with a Kirschner wire on the eighth postoperative day. Aside from this minor complication, the postoperative course in each case was essentially uneventful.

REPORT OF CASES

CASE 1.—A 15-year-old white boy had been seen at this clinic four years earlier. Questioning revealed that he was born with a bilateral cleft palate. From the age of 2 to 4 years, four operations were performed in an attempt to close the cleft in the palate. Over the past four years, the patient had had intensive orthodontic treatment directed toward prevention of collapse of the upper alveolar segments. Examination revealed pronounced underdevelopment of the maxillae and extreme retrusion of the central third of the face. Prognathism was present. Examination of the oral cavity showed a short, scarred, immobile palate and collapse of the lateral alveolar segments. The premaxilla was surgically absent. The upper dental arch contained but two teeth.

Reconstruction was carried out by transplantation of an iliac bone graft measuring 6 by 4 by 3 cm. (See illustrations).

CASE 2.—A white man aged 21 was first examined in this clinic at the age of 16, with congenital bilateral harelip and cleft palate. The primary lip repair was carried out when he was 7 weeks old. In the primary repair of the lip the premaxilla was excised and the lip closed by a procedure that utilized both the prolabium and the lateral segments of the lip for the formation of the central portion. At the age of 2 years, the cleft in the palate was closed. Initial examination at this clinic revealed extreme underdevelopment of the maxillae, with retrusion of the central third of the face. Marked residual scarring of the lips and moderate prognathism were also in evidence. Examination of the oral cavity showed a large, anterior rhino-oral fistula and a short, scarred, immobile palate. The premaxilla was surgically absent. Severe collapse of the alveolar segments was noted. Orthodontic treatment was instituted, and the patient was fitted with an orthodontic appliance. For the past two years the patient has undergone numerous operative procedures directed at obtaining better speech and improvement in facial contour.

Surprisingly, a review of both the American and the British journals of plastic surgery indicates that little attention has been devoted to the correction of secondary deformities resulting from operations for harelip and cleft palate procedures, such as the operation here described. Ragnell[16] has reported the use of iliac bone grafts for restoration of facial contour in certain cases of "dish face" deformity. Figi[17] and others[18] have presented patients with facial deformities due to other causes, successfully treated by the

use of Esser inlay skin grafts and orthodontic appliances for restoration of facial contour. Pickrell[18c] has reported on the use of fascia, tendon, and dermal grafts for the correction of flap lip deformity. Brown and McDowell,[19] in their text book *Plastic Surgery of the Nose,* reported the use of L-shaped bank cartilage transplants in cases similar to the 2 here reported. It would seem that the autogenous bone graft would be the ideal type of graft for the achievement of permanent results.

It is our opinion that the results obtained in these 2 cases justify further trial of this procedure for the restoration of facial contour in patients on whom premaxillary operations have been performed early in life.

ZUSAMMENFASSUNG

Der Verfasser beschreibt, wie er ein Knochentransplanat vom Darmbein zur Korrektur von Rueckwaertsverlagerung des Kiefers bei Kranken mit Wolfsrachen verwendet. Das Transplantat wird vom oberen Rande der Darmbeinschaufel entnommen, und die Operation findet unter endotrachealer Narkose statt. Es wird ueber zwei Faelle an Hand von Illustrationen berichtet. Beide Male war der Erfolg zufriedenstellend, und der Verfasser glaubt, dass ein weiteres Studium der Möglichkeiten dieses Operationsverfahrens gerechtfertigt ist.

RESUMEN

El autor describe el uso de injerto de hueso ilíaco, en la corrección de la retrusión maxilar en pacientes con dehiscencia del paladar óseo. El injerto se toma de la cresta ilíaca y la operación se efectúa bajo anestesia endotraqueal. Se reportan e ilustran dos casos. Los resultados fueron satisfactorios en ambos y en la opinión del autor, justifican futura investigación de las posibilidades de la operación.

RÉSUMÉ

L'auteur décrit l'usage de une greffe iliaque pour la correction de retrusion maxillaire chez les malades des atteints de fissure du palais. Il présente deux cas dans lequel l'usage de cette greffe était suivi de succès. Dans son opinion, la technique bien mérite de plus encore études et investigations.

RIASSUNTO

L'autore descrive l'uso di uno trapianto di osso iliaco per la cura del retruzione mascellare nei pazienti con palatoschisi. Egli riportate duo casi con buoni risultati. L'autore é d'avviso, che il metodo proposto possa essere utile nei pazienti con palatoschisi. Egli racommandate avanziamento di investigazione del iliaco trapianto.

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Editorial

Hall of Fame Lectures

MEDIEVAL SURGERY

(CIRCA 500 to 1500)

LOREN C. McKINNEY*

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THE history of medieval surgery, like the history of almost any aspect of Western European civilization during the Middle Ages, can be divided into two periods: the early, or so-called "Dark" Middle Age from about 500 to about 1000, and the late, or High Middle Age, from about 1000 to about 1500. Without quibbling as to the inaccuracies inherent in any such arbitrary dissection of the corpse of history, I start with a survey of surgery during the first of these periods.

*Professor of History, University of North Carolina.

Lecture given at the International Surgeons' Hall of Fame on Dec. 4, 1956, in the series offered by the School of the History of Surgery and Allied Sciences of the International College of Surgeons.

Prof. Loren C. MacKinney*
Kenan Professor of History
University of North Carolina

Many writers apply to this early portion of the Middle Ages the Gibbon-esque title, "Decline and Fall of (whatever topic is under consideration)." Although I am temperamentally opposed to epoch generalizations, I adopt this title, in slightly amputated form, as a text for my coverage of Western surgery during the early Middle Ages. I call it merely the "Decline," eliminating the expression "fall," since surgery, like other classic activities did not cease abruptly in 476 A.D. or any other specific date. Nor do I approve of the term "dark." Surgically, and otherwise, the centuries following the disintegration of the Roman Empire were not a black night of barbarism, but rather a roughly vigorous age of reconstruction, of pioneering on new frontiers of civilization. To employ a medical simile, it was as if the weakened body of the late Roman civilization had received a transfusion of sturdy, barbaric, red blood corpuscles.

But, without further historical philosophizing, let us turn to the factual evidence concerning surgery during the period following the death (in Rome) of the sixth-century Greek physician, Alexander of Tralles and (in Alexandria) of his surgically minded successor, Paul of Aegina. These two men, trained in Graeco-Roman

scientific traditions, transmitted a considerable amount of surgical book-learning to the medieval worlds of Islam and Christendom. Since Paul of Aegîna lived in Egypt after the Arab conquest (641-2), his medical encyclopedia, the *Epitome*, the sixth book of which dealt with surgery, provided the world of Islam with the classic theories of Galen and the advanced surgical technics of the Alexandrians. Since Dr. Spector has dealt with these in his lecture I shall not repeat them, but merely suggest that (1) they impress modern surgeons most favorably, (2) they were taken over by the Arabs during the ensuing medieval centuries, and (3) they were followed quite faithfully in the Eastern (Byzantine) regions of Christendom, but were in large part disregarded in Western Europe.

The Arab world carried on the classic tradition with certain modifications, and eventually transmitted Graeco-Arab principles of surgery to Western Christendom. Arab civilization, the product of an imperial organization stretching from India to Spain along the principal waterways of civilization, provided a huge melting pot of ancient cultures. Along with other treatises, the works of classic physicians and surgeons, translated into Arab, Syriac or Persian, were commented on and expanded during the period following the seventh-century Arab conquests. Among the examples of constructive Arab attitudes toward subject cultures was the work of the Christian physician, Ibn Masawaih (commonly known as Mesue the Elder). Reared in Gundisapora, Persia, at about 800 A.D., he practiced, wrote and taught medicine, notably ophthalmology, in Bagdad. Thanks to the caliph's patronage, he was even supplied with apes for anatomic dissection. Jewish physicians, like Christians, flourished under the tolerant policies of the Arab Empire.

A noteworthy aspect of Arab surgery during these early centuries was its close relationship to medicine. This is exemplified by the writings and practices of physician-surgeons like the famous Avicenna, whose *Canon* won for him the title "The Arab Galen" and in its Latin translation threatened to eclipse Galen's influence in the Christian West. Of greater importance surgically was his contemporary, Abu-l-Qasim (Abulcasis), a Spanish Moslem whose *Encyclopedia of Healing* included three books on surgery which was circulated widely in the West in a separate Latin translation. Along with Avicenna, Abulcasim subordinated the surgical scalpel to the cautery iron, the use of which he treated in detail in the first of his three books on surgery; books II and III dealt with surgical instruments and operations, and orthopedics. Much of his surgical information was derived from classic sources, for example, Paul of Aegîna's *Epitome*, but he introduced many new features that were new to his day. The Latin manuscripts of his *Surgery* are noteworthy for the numerous illustrations of surgical instruments—over a hundred of them in some cases.

In summarizing the contributions of the early Arabs to surgery we venture the opinion that they were more than blind imitators of the Greeks, in that they made minor improvements in surgical instruments, suturing, ligatures, obstetrics, orthopedics and operations on eyes, *fistula in ano* and so on. On the other side of the ledger are several negative factors, most of them heritages from classic theory and practice: (1) the doctrine of humors and temperaments; the corollary thereof, (2) constant resort to bloodletting and cautery (to drain off noxious humors), and (3) a static knowledge of anatomy (dissection, restricted to animals, was even rarer than in classic times). Perhaps the least progressive of Arab influences on the West was the popularization (especially by Abulcasis and Avicenna) of astringents and cauterization. However, in spite of failings, the influence of medieval Islam on the West was predominantly progressive.

If the Arab world of the early Middle Ages fails to live up (or down) to our theme of surgical "Decline," the Christian West from about the year 500 to about 1000 is generally supposed to have de-

served this, and any other derogatory epithet. Just twenty years ago as a setting for my Noguchi lectures on *Early Medieval Medicine,* I quoted a number of examples of the prevailing "Dark-Age" concept, then reversed myself and presented the *constructive* aspects of medicine during that period. I have not time here to repeat the procedure, but I quote one dark generalization as an example of what I believe the early Middle Ages were **not.** In a twentieth-century "Rhymed Outline of Medical History" the entire Middle Ages was dismissed with the following:

> "Throughout the Middle Ages, Medicine was devoid of sages,
> Save for one leap from inferno (Wisdom nurtured at Salerno
> By helping hospital and nurse), Those years could otherwise be worse."

Undaunted by this jingle, I now leap into the dark-age "inferno." For support I rely on the following summary of early medieval surgery, penned by Dr. Henry Sigerist in a letter written about two years ago.

> "It is very hard," he wrote, "to tell what surgery was like before 1100, as we have so little literature on the subject. The surgeons were mostly uneducated craftsmen who could not read and write, and operations were transmitted without books, from father to son and master to apprentice. . ."

Granted that the evidence is sparse, what does it show as to surgery?

Most of the early *medical* treatises and manuscript illustrations, subordinate surgery to medicine proper, and especially to *materia medica.* Similarly, most accounts in *non*medical treatises deal with (and

Portion of Dr. McKinney's audience at the International Surgeons' Hall of Fame, Chicago, Dec. 4, 1956.

stress) the importance of potions, salves and supernatural intervention. Nevertheless, the existence of surgery is evidenced by numerous scattered references in both medical and nonmedical treatises. The most prominent aspect of surgery was bloodletting, an inheritance from classic times, based on the theory that noxious humors must be drained off. This practice prevailed throughout the early and late Middle Ages, also in modern times even to George Washington's day. (It is thought that excessive bleeding rather than the ailment is what killed him.) However, in the early Middle Ages, bloodletting was worse, and there was more of it, thanks to the belief that it was a "Hippocratic" remedy.

Medical handbooks of this period invariably contained treatises on bloodletting, either anonymous or attributed to Hippocrates or other classic authorities. In one of them, attributed to the Venerable Bede, but apparently compiled from various classic sources, along with advice concerning the days on which it was safe, or unsafe, to bleed or purge, is the following:

> ". . . at all times, day or night if need be, one ought to resort to bloodletting in acute fevers. . . Open the veins in the back of the neck for headache and madness, . . . two veins below the tongue for disease of the mouth or toothache, . . . two veins from above the great toe for injury of the testicles. . ."

Even less impressive, from the standpoint of general intelligence and surgery, is the following, taken from a manuscript of the late eleventh century. It asserted that bloodletting

> "contains the beginning of health, makes the mind sincere, aids the memory, purges the brain, restores the bladder, warms the marrow, opens the hearing, checks tears, removes nausea, benefits the stomach, invites digestion, evokes the voice, builds up the senses, moves the bowels, enriches sleep, removes anxiety, nourishes good health."

If medieval people believed such optimistic talk, and well they might since it was part of their classic heritage, little wonder that they resorted to boodletting not only for all sorts of specific ailments but also periodically as a general health measure. Calendars indicated lucky and unlucky days not only for bloodletting but also for purging and indulging in certain foods, drinks and pleasures. Manuscript illustrations showed, often with red spots, the places from which to draw blood.

The methods used for bloodletting were (1) puncturing a blood vessel from which the blood spurted into a jar or pan; (2) placing cupping glasses on slower flowing veins and (3) placing leeches, usually on the legs. Sometimes the results were precarious; medieval (like classic) literature contains references to dangerous swellings that sometimes ensued. Undoubtedly many a person, like George Washington, was bled to death.

Nowhere in the literature of the early Middle Ages is there any evidence to the effect that bloodletting was performed by a special class of surgical practitioners. This is of importance in the face of the almost universal opinion of our day that throughout the Middle Ages bloodletting was done by barber-surgeons. Wherever mentioned, the early bloodletters were called "medics" (*medici*, in the original Latin). To be sure, by the late eleventh century, at Chartres and some other north-French centers, there were *rasators* and *sanguinators*. These, we surmise, were similar to the barber-surgeons of later centuries.

The same situation prevailed with regard to the surgery that was of a slightly higher order than bloodletting; namely, treatment of wounds, operations, and cautery. In early Germanic law codes, regulations concerning headwounds, refer to "medics," never to surgeons *(chirurgi)*. Similar evidence is found in the writings of churchmen.

A possible explanation for this terminology lies in the fact that during the early Middle Ages surgery declined almost to the vanishing point. What remained was

primitive, comprising for the most part simple operations such as bloodletting, which could be performed by almost any intelligent man. Wounds were usually treated medically rather than surgically, by applying medicines, medicated sponges or packs. Thus most ailments could be handled by clergymen or laymen trained in fundamentals comparable to a modern first-aid course. There was no place for a specialized profession.

Occasionally a problem in obstetrics, too complicated for the midwives, might be solved by a cesarean section. In sixth-century Spain a bishop of Merida was reported to have saved a mother as follows: "With marvelous skill he made a neat incision with a fine knife and quickly extracted piecemeal the already putrid infant." From St. Gall in the ninth century comes a slightly different case, one in which the baby was saved and the mother apparently lost. Fourteen days ahead of nature's schedule, according to the chronicler, "the infant was cut out of the mother's body and wrapped in the fat of a newly killed pig."

During this warlike age, there was considerable military surgery, probably of a very primitive sort, the amputation of limbs, for example. The law codes mentioned above contain many brief references to wounds which called for surgery of a sort, but no details are recorded. Ninth- and tenth-century chronicles, likewise, make brief references to operations. There is, however, no evidence of anything but the simplest of methods, like the application of medicines to wounds.

From the sixth century Frankish History of Gregory of Tours, however, comes a noteworthy exception. A Frankish royal physician (called *archiater*) told how he had "excised" a boy's testes, performing the operation "the way he once had seen it done by 'medics' in Constantinople." Here is a rare example of the persistence in the Germanic West of a late Greek professional title and of a Greek operational technic. No details are given as to instruments and the like. In general, the surgical instruments mentioned in early treatises, and also the finds of archaeologists, reveal only primitive implements, medicinal packings and simple bandages—among them some for hernia.

We already have called attention to the practice of cauterization, which was performed with a heated knife or iron. Although mentioned in the sixth century as a means of eliminating diseased tissues in both human beings and animals, thenceforth until the eleventh century it all but disappears from Western medical literature. Meanwhile a different usage had captured the Arab world; the application of the cautery iron not only to diseased tissues, but also to various places on the body for the relief of internal as well as external ailments, by drawing the noxious humors to the artificial wound. Manuscripts of the later centuries contain illustrations of human bodies marked with red spots (like those for bloodletting) to indicate the places at which the iron was to be applied. The direct cauterization of wounds was more intelligently handled in both Arab and Christian lands.

Already I imagine that some of my hearers are wondering why I have not mentioned Salerno as an example of light in the dark ages. As a matter of fact I am about to mention it, but in a derogatory fashion of which you may disapprove. Our quoted poetic physician notwithstanding, I deny that the "wisdom nurtured at Salerno" constituted a uniquely progressive center in which the torch of enlightened Greek medical science was held aloft. For example, during a quarter of a century or more of perusal of the sources concerning medicine in the early Middle Ages, I have looked in vain for solid evidences of a medical "school" at Salerno.

Without claiming omniscience for the authorities I cite, I wish to present evidence to the effect that medieval surgery and medicine neither began nor ended with Salerno, a name which might well be eliminated from the historical headlines.

Professor Lynn Thorndike, an experienced, sober researcher in matters medieval is, in his own words,

> "inclined to view with some skepticism the assumption . . . that the word Salernitan represents a separate body of doctrine or of method in practice, which may be sharply distinguished from Arabic influence. Rather the medical literature and practice of Salerno is an integral and scarcely distinguishable part of *medieval medicine as a whole* . . ."

I am inclined to press this opinion a bit further, asserting that *early* medieval medicine is not "sharply distinguishable" from Salernitan medicine. Salernitan medical treatises were antedated, and probably derived from, writings of which we have extant copies in earlier North- as well as South-European manuscripts. In short, it seems that observations of the early Salernitans paralleled those of the early northerners.

To this generalization Salernitans can claim an exception if they appropriate a tenth-century Jewish physician, Donnolo, from a region about two hundred miles east of Salerno. Donnolo was born at Otranto; he traveled widely, practiced for about forty years and wrote (in Hebrew) the earliest known medieval Italian medical treatise. Thus, if we follow existing evidence, South Italy's medical "first" is found in a *civitas HEBRAICA* on the Otranto heel of the peninsula, rather than in a *civitas HIPPOCRATICA* on the Salerno shin-bone.

Neither Donnolo's treatise nor the earliest known medical products of Salerno itself are surgically unique. I refer especially to Gariopontus's *Passionarius* and Petroncellus's *Practica*, both of which I have found to be remarkably similar, in subject matter and approach, to earlier treatises from Chartres and St. Gall, both northern clerical centers. Similar evidences from other manuscript sources lead me to the conclusion that Salerno before the eleventh century was unimpressive.

There is no evidence of a university, of a medical school or of a *Civitas Hippocratica*. Documents prior to 1000 A.D. contain only brief references to a few "medics" at Salerno, and none to surgeons (*chirurgi*) or to an educational institution. The record even shows that Salerno had a *bad* reputation in northern Europe. A late-tenth-century chronicler in France wrote that in 929 at the French royal court a liberally educated French cleric-physician completely discomfited a practically trained Salernitan physician in a symposium concerning pharmacy, pharmacology, botany and surgery. When the Salernitan sought revenge by poisoning his victorious rival, he was himself out-poisoned and forced to have a foot amputated, and this by local *surgeons* (*chirurgi*). Granted that the story has a French bias, it indicates that physicians, and surgeons, were to be found outside Salerno in the tenth century; also that an Italian could be out-poisoned by a Frenchman. At least two other medieval French writers viewed Salernitanism with similar suspicion, and there are reliable modern scholars who have expressed doubts concerning Salerno's early reputation. I refer to Professors Lynn Thorndike and Paul Kristeller, and Dr. George Corner. In Dr. Corner's words:

> "We must abandon altogether the poetical view of this place as a last outpost of the true Hippocratic learning. Nothing remained here, any more than elsewhere in Europe, of undiluted antique medicine. The important thing that happened at Salernum to set it off from the rest of Italy and to make its medical school pre-eminent in the grand awakening of Europe, was the introduction of Oriental (i.e., *Arab*) learning, at the end of the eleventh century."

Only toward the end of the eleventh century is there evidence of a medical center at Salerno. So far as a university is concerned, there was no formal recognition of one until the fourteenth century. Equally certain is the lack of evidence that the early Salernitan medical profession included women, like Trotula. The early records contain numerous references to *clerical*-"medics" but none to *women-*

"medics." The earliest mention of the legendary Trotula comes from the thirteenth century. Interestingly enough in these *later* centuries Salerno had *more* women and *fewer* clerics. In 1321 a woman (not Trotula) was licensed to practice surgery. Meanwhile, ecclesiastical regulations were discouraging clerics from studying either civil law or medicine anywhere.

To summarize, in the 1000's Salerno was emerging, and as we shall see, soon was to progress rapidly in surgery and anatomy. But, what about the rest of Europe? Nowhere in the West at this time was there a well-developed medical school, with any emphasis on surgery. Any claims of antiquity for Bologna, Montpellier or Chartres (like those for Salerno) are overly optimistic modern assumptions. In the West, the five hundred years from 500 to 1000 illustrate convincingly the decline of classical surgery. Whatever remained were merely scattered relics of Graeco-Roman theory imbedded in manuscript handbooks, and generally disregarded by practitioners.

The Late Middle Ages

The foregoing pessimistic observations hold good only for the period prior to 1000. Thereafter the historical record reveals marked changes for the better in Western Europe, and by curious contrast a rather steady decline in Arab lands. Western medical and surgical progress was for a time most notable in Southern Italy, in the *region* of Salerno, if not actually in that town.

This stemmed in particular from the Graeco-Arab works translated into Latin shortly before 1100 by a monk called Constantine the African, who probably lived at Salerno for a while but who wrote and died at the monastery of Monte Cassino. For example the earliest Salernitan surgical work, often referred to as "the first modern textbook on surgery," comprised in large measure (about one half) material copied from book IX of Constantine's *Pantegni*, which in turn had been translated from book XIX of the *Kitab al Maliki* of Ali ibn Abbas, a tenth-century Persian, who in turn had borrowed it from book VI of the *Epitome* of the seventh-century Byzantine Greek, Paul of Aegina, who indicated in the prologue of his work that he had appropriated "the cream of what others had written"; specifically that written by the fourth-century Greek, Oribasios, who in turn had drawn so heavily on Galen's works that often he is called "the ape of Galen." Indeed the roots of "the first modern textbook on surgery" lie deep in its own non-Salernitan, medieval and ancient, past.

It seems to me that this early Salernitan surgery comes closest to uniqueness in the field of anatomic dissection. To be sure, the use of animals, and also of human beings to a lesser extent, was known in classic times, but it seems to have been unknown to the Christian West until shortly before the year 1100. At that time, Constantine's Latin translations gave a new impetus to Galenic ideas of anatomy, but there is no trace of actual anatomic dissection until some time later. By the end of the twelfth century, three so-called "pig anatomies" had appeared. A quotation from one of these, which is attributed to a certain Copho, shows the practical manner in which anatomists were working:

> "Place the pig on its back and incise its throat in the middle. The first thing which presents itself is the vocal organ which is bound on the right and left by certain nerves . . . Next separate the *Trachea arteria* from the oesophagus in order to expose the lung and heart . . ." and so on throughout the body.

It is apparent from such accounts that the men who followed the instructions given therein were studying anatomy intensively and perhaps experimentally. During the second half of the twelfth century the pig anatomies were supplemented, if not supplanted, by both Salernitan and North-European treatises that mark a shift in emphasis from pigs to human beings. This change is evidenced in a North-European

manuscript from a Bavarian monastery, written about 1158 and attributed to Galen. It was accompanied by human anatomic illustrations, much earlier in origin and of wide usage, extending even to Persia and China. Sudhoff and other specialists have suggested that such anatomic studies, possibly based on human as well as animal dissection and recorded in manuscript illustrations, stemmed from ancient Alexandria, whence they had spread into Asia (as far as China), into the Mediterranean region (as far as the Arabs penetrated) and eventually into North Europe. A recently excavated catacomb in Rome may throw important light on this problem. Therein is a fourth-century fresco depicting what is said (by some authorities) to be a professor of medicine and twelve disciples, viewing a dissected corpse demonstrated by a prosector.

Meanwhile, surgery proper had been keeping pace with anatomic dissection. Again, tradition has attributed to Salerno the entire credit, whereas recent manuscript researches spread the responsibility more broadly. Manuscript evidences prove that twelfth-century Italy had added to the medieval classic corpus on bloodletting, wounds and cautery certain new technics, derived from Constantine's treatises as well as from practical experience. In short, the old things were being handled more effectively, and something new was being added.

As an example I cite passages concerning the famous "soporific sponge." They prove that it was not a new discovery, but an early medieval improvement on an ancient anesthetic potion of mandragora.

As specific evidence from early medieval, pre-Salernitan North Europe, I cite two prescriptions from the period just after Charlemagne. The first is merely a medieval repetition of an ancient potion described by Dioscorides and Celsus in the first century. It is found in the medical part of a ninth-century clergyman's encyclopedia. In describing the herb, mandragora, Archbishop Rabanus Maurus wrote:

> ". . . the root mixed with wine is given for drink to those whose bodies must be cut for healing, so that asleep they will not feel the pain . . . (he added) it is comparable to the virtues of the saints . . ."

More impressive are the twin descriptions of soporific *sponges* in medical manuscripts of the ninth and tenth centuries, published by Sudhoff and Sigerist. The Latin texts are similar.

> "A hypnotic or soporific aid, for those to be healed by surgery so that, being asleep, they will not feel the pain: take seed of Thebaic opium 1 ounce, juice of mandragora leaves 8, juice of fresh hemlock with juice of hosciamus, with sufficient water to make a juice; collect the juice in a coarse dry sponge and dry it well. To use the sponge, soak and warm it, place on the nostrils so as to take away the patient's very spirit until he sleeps. To wake him, take another sponge soaked in warm vinegar, place it on the nostrils and it will end his sleep."

The twelfth-century Salernitan version, 250 years later, often hailed as a "first," is almost identical, even in wording. The same holds true for the thirteenth-century Bologna version.

Not all of the surgical evidence is so disturbing to Salerno's reputation. We quote a passage from a twelfth-century *Surgery* concerning operations of the testes. As compared with the cited case of a sixth-century excision of testes it indicates a much improved technic.

> "If the intestines descend [into the scrotum] we operate surgically as follows. The patient is placed with his feet elevated and the scrotum is cut from below so that the testicle itself appears. It is grasped in two fingers and by lifting it by the finger nails or tearing it away from the intestine itself, it is drawn toward the pubic bone and extracted. It is then sutured above with a large needle and firmly ligated with thread so that the ends of the ligature hang together

> from the wound. After this, the testicle is cut away from the intestine with hot irons, a little below the ligature in order not to loosen it. . . . When the putrid and burned flesh comes away, that is to say about the 7th or 8th day, we remove the cord. . . ."

Similarly impressive is a description of intestinal suturing, from the *Surgery of Roger*:

> ". . . If the intestine becomes herniated by any wound . . . in the first place if the weather is cold . . . a live animal is cut down the middle and laid upon the intestines and left there until they become warm and . . . softened. Meanwhile a cannula is made of elder wood in the shape of the wound of the intestine, but one inch longer than the wound at each end. . . . It is inserted through the wound, which is sewed with a sharp needle and a silk thread. The cannula is placed there in order that the contents of the intestine may pass through it and that the suture may not make an obstruction. . . . The dirt is washed gently, . . . the intestines are replaced in the abdomen . . . and then the patient is placed on a plank and shaken in order that the intestines may slide into their proper place. . . ."

This technic, which was used by Roger and perhaps by other twelfth-century surgeons, was improved later by substituting for the wood cannula a windpipe cut from an animal. It is obvious that these men were improving on their predecessors in operational procedures.

It is apparent, however, that South Italy, the region of Roger and Constantine, though progressive, was not the only region of progressive surgery. In fact North Italy eventually surpassed Salerno both in the quantity and the quality of its surgical writings. Roger of Salerno was followed by Master Maurus and Johannes Jamati, but Roland of Parma's work centered in North Italy, and the "Four Masters" are thought to have been French. So far as the famous health poem, entitled "The School of Salerno," is concerned, it contains nothing of importance concerning surgery. Meanwhile Constantine's translations of Arab treatises were being rivaled by new translations by Gerard of Cremona in Spain. As a result the Arabs, Avicenna and Abulcasim, were soon to become as important as the Constantinian translations of Galen and other classic writers.

Shortly after the twelfth century, surgical interest moves northward, leaving Salerno with its past, and fading, glory. However, one final glimpse reveals it, shortly before 1250, as a still flourishing surgical center, recognized as the greatest in his realm by the Hohenstaufen emperor of South Italy and Sicily, Frederick II. The constitution promulgated for his kingdom in 1231 at Amalfi, a few miles up the coast from Salerno, contained detailed regulations "Concerning Medics." They must study for three years as pre-"medics," then five years as "medics," including some study of surgery. After examination and certification by the professors at Salerno, the royal court granted the candidate "a license to practice," but only after one year of apprenticeship under an experienced physician. A surgeon could be licensed separately, after testimonials from his professors proved that "he has studied for at least a year in that field of medicine which develops skill in surgery, and in the anatomy of human bodies, and also that he is proficient in that field of medicine without which incisions cannot be safely made, nor fractures healed." From the fact that the twelfth-century regulations of Frederick's Norman predecessor (King Roger II), on which his were based, contained no specific provisions concerning surgery, we may infer that surgery as a separate profession emerged at some time between 1150 and 1250 at Salerno as well as in more northerly regions. One other point, Frederick's regulations restricted the teaching of medicine and surgery in his realm to Salerno, and to professors licensed by action of both their fellow professors and state officials. The age of state-controlled medical schools and practice had arrived. After the time of Frederick, the record shows more remarkable progress in North

Italy and France than in the Salerno region.

In many lines of intellectual and artistic evolution, it is said that Italy has been the dynamic force for progress in northern Europe. This is obvious in the case of medieval surgery, and it is North Italy that does it. Bologna, like Salerno, a university whose origins are "veiled in impenetrable obscurity," was a flourishing medical center before the thirteenth century, but its earliest known surgeons were from that century. There was Hugh of Lucca who learned much as a military surgeon on crusading expeditions, his surgeon son Theodoric, a Dominican friar who became a bishop, and William of Saliceto, the greatest of the early surgeons of Bologna. He probably introduced a number of improvements, like the suturing of severed nerves, the differentiation of arterial (spurting) blood from venous blood and a return to reliance on the knife instead of on the excessive cauterization recommended in Arab medicine. Other North-Italian centers, Padua, for example, attracted and produced noteworthy physicians and surgeons, among them Bruno of Longoburgo, Salerno-born and educated, but a practitioner in Padua and Verona. He was one of the all too small number of surgeons who advocated the aseptic, non-suppurating treatment of wounds.

If one compares the dates of thirteenth-century Italian and French surgeons, he will find that French progress was about a half-century behind that of North Italy, just as North Italy lagged behind South Italy. Another noteworthy fact is that French progress was inspired by North-Italian *emigres*. For example, the first outstanding surgeon in France was Lanfranc of Milan, a pupil of Saliceto, the Bologna professor. Lanfranc, banished from Milan for political reasons, migrated to France, eventually settling in Paris. Being married he was ineligible to teach in the clerically controlled university. However, he attained almost immediate success by reason of his intelligent operational methods and his treatise on surgery. Becoming a member of a newly established surgeons' guild—the Confraternity of St. Cosmas—he helped to establish the reputation of the profession. This was an important development in French surgery.

Some years earlier the educated surgeons of Paris, considering themselves superior to the barber-surgeons, had organized a guild, which eventually became the Confraternity of St. Cosmas. About the year 1300, the guild was given official recognition, and eventually became the rallying point for French surgeons in their successful efforts to keep barber-surgeons in their place, as "Surgeons of the *Short* Robe," while attaining for themselves, as "Surgeons of the *Long* Robe," a position comparable to that of the physicians.

Lanfranc not only contributed to the rise of the surgical profession in France, but is credited with having checked prevailing excesses and defects in trepanation and in operations for cataract, stone and hernia, (for which he urged the use of trusses). He also made moderate use of cautery, (which had been discredited by certain Bologna surgeons). Another example of his intelligent conservatism was his opposition to the current tendency to leave bloodletting and minor operations to the barber-surgeons. He upheld the unity of medicine and surgery as coordinate parts of the healing art.

Contemporary with Lanfranc was another of Saliceto's pupils, Henry of Mondeville. Norman born, he had received his basic surgical training at Bologna, later studying and teaching at Montpellier and Paris. Along with a younger contemporary, Guy of Chauliac (d. 1368), who also studied at Bologna, he brought French surgery and anatomic knowledge to a level comparable with that of Italy. With them medicine, surgery and anatomy formed a healing trinity. Chauliac expressed the necessary inter-relationship of surgery and anatomy when he wrote: "the surgeon who is ignorant of anatomy carves the human body as a blind man carves wood." With him the evolution of Italian anatomic dissection culminated, and cap-

tured France. Already at least a century old in Italy, twelfth-century pig-dissection had given way to the dissection of human beings, first, it seems, by way of judicial postmortem examinations, introduced in Italy for the purpose of determining the causes of death. At Bologna—famous both as a legal and medical center—judicial and medical postmortems became common late in the thirteenth century.

Mondinus Luzzi, who graduated from the medical school at Bologna in 1300, practicing and teaching there until 1326, dissected freely. He was reported to have dissected a pregnant sow and two women's corpses in 1315-16. In these and other cases he probably did his own dissecting, in public and for anatomic instruction. Another Italian physician-surgeon, Gentile of Foligno, conducted public dissections and autopsies at Padua in 1341. Meanwhile, Guy of Vigevano, an Italian-born French royal physician, in a brief *Anatomy*, pictured and described some of the actual methods of dissecting. The earliest recorded North-French dissection occurred in 1407; it was performed at Paris, for the instruction of barber-surgeons and under the supervision of the dean of the medical school of the University.

In the light of such multiple evidences, from France as well as Italy, it is strange that scholars of our day still write of "the first public dissection by Vesalius in 1541." This all too popular Renaissance dating might well be moved back at least two centuries and labeled "Medieval."

With regard to *operational* surgery, Chauliac also marks the culmination in France of most of the improvements we have mentioned in connection with Italian surgery.

Among the unusual new items (mentioned by Chauliac, but not necessarily attributable to him as originator) are the following:

- caution against operations for bladder stones
- impossibility of successfully operating for kidney stones
- wisdom of closing chest wounds where there is no drainage
- danger of exposing to the air open intestinal wounds
- description of five kinds of sutures
- description of dental instruments
- use of weights and pulleys for traction in thigh fractures

The later history of French surgery reveals one factor to which many historians seem to be oblivious, the *immanent* decline, or at least the leveling off of scientific progress (along with civilization in general), in the fourteenth and fifteenth centuries, especially during the period of the Hundred Years War and the recurring visitations of the Black Death. For example, surgeons of this age reverted to the doctrine of "laudable pus" in the treatment of wounds. They also clung to many medical ideas that are considered medieval, and unworthy of the Salernitan and post-Salernitan pre-Renaissance era. Among the worst of these were the attribution of the Black Death to astrologic conditions, to Jewish poisons or both, and the use of bloodletting as a remedy. Throughout the works of many late medieval surgeons there is also a surprising amount of reliance on medicinal ointments, salves, powders and potions, some of which contained caustic substances and minerals far more harmful than those in the earlier herbal *materia medica.*

Apropos of the discouraging trends in surgery, we mention one notable exception, an English surgeon, John Arderne (d. circa 1377). He was a self-educated man in both literary and medical lore, and, after wide experience as a military surgeon, he practiced in outlying parts of England and finally in London. He is a remarkable example of those characteristics which are so often attributed to the early Salernitans. To be specific, he was a practical-minded, self-taught surgeon, educated by personal experience rather than from books. He followed the procedures of the most progressive of his predecessors, operating boldly, keeping instruments and wounds

clean, and avoiding suppuration and frequent changes of dressings. His major contribution to surgery was the operation for *fistula in ano,* which he based on Abulcasis's Arab technics modified in accordance with his own experience, as is evidenced by the numerous illustrations and case histories included in his treatise. Noteworthy in the many extant manuscripts of his work are the sketches and explanations of the instruments used in the operation. Another of his well illustrated works, *The Art of Medicine and Surgery,* has attained recent fame by reason of an early-fifteenth-century copy, found in Stockholm and containing many brilliantly colored illustrations, in unusual scroll form. This manuscript may have been sent to Scandinavia for an English princess who was queen of these realms until 1439. It is merely one of the rarer examples of the wide range of transmission of medieval and surgical knowledge, and of its prevalence in marginal regions of the West that are often neglected in historical surveys. May I, then, end my presentation with the reminder that I have omitted much concerning medieval surgery, not only because of shortage of time, but also because of the shortage of modern knowledge of what our forebears in various parts of Europe knew about surgery.

[Professor MacKinney showed 50 projection slides, all color reproductions of medical miniatures from medieval manuscripts, to illustrate bloodletting, cautery, famous medieval surgeons, surgical clinics, surgical operations—on heads, arms, legs, chest, abdomen, sexual organs, fistula, cesarean sections and so on—postoperative treatment, orthopedics and dentistry. These slides were merely a sampling of the surgical section of Professor MacKinney's collection of about 3,000 photographic reproductions of medieval medical miniatures, obtained in the principal manuscript centers of Western Europe. The collection also comprises miniatures concerning pharmacy, materia medica, anatomy, pathology, gynecology, balneology, medical education, medical instruments and veterinary science.]

You ask, if I would agree to live my seventy or rather seventy-three years over again? To which I say, yea I think, with you, that it is a good world on the whole; that it has been framed on a principle of benevolence, and more pleasure than pain dealt out to us. There are, indeed (who might say nay) gloomy and hypochondriac minds, inhabitants of diseased bodies, disgusted with the present and despairing of the future; always counting that the worst will happen, because it may happen. To these I say, how much pain have cost us the evils which have never happened!

—*Jefferson*

New Books

Books Received.—The following books have been received by the Editor; they will be reviewed critically as space and facilities permit. Omission of more extended review, however, is not to be taken as criticism of the merit of the book.

Bases Physiologiques de la Chirurgie Neuro-Vasculaire (The Physiologic Bases of Neurovascular Surgery). By C. Mentha. Paris: Masson et Cie, 1956. Pp. 148, with 32 illustrations. *Reviewed in this issue.*

Lymphatics, Lymph and Lymphoid Tissue. By Joseph Mendel Yoffey and Frederick Colin Courtice. Cambridge, Mass.: Harvard University Press (for the Commonwealth Fund), 1956. Pp. 510. Illustrated.

Handbook of Physical Therapy. By Robert Shestack. New York: Springer Publishing Company, Inc., 1956. Pp. 212.

Atlas of Tumors of the Nervous System. By H. M. Zimmerman, Martin G. Netsky and Leo M. Davidoff. Philadelphia: Lea & Febiger, 1956. Pp. 191, with 277 illustrations (233 in color).

Etiologic Factors in Renal Lithiasis. By Arthur J. Butt. Springfield, Ill.: Charles C Thomas, Publisher, 1956. Pp. 401, with 153 illustrations. *Reviewed in this issue.*

Chirurgia du Pancréas. By Lucien Leger and Jacques Bréhant. Paris. Masson et Cie, 1956. Pp. 504. Illustrated (collection of Henri Mondor). *Reviewed in this issue.*

How to Enjoy Good Health. Edited by Cyril Solomon and Brooks Roberts. New York: Random House, 1956. Pp. 240.

Diagnostic Procedures for Virus and Rickettsial Diseases. American Public Health Association. New York: Publication Office, American Public Health Association, 1956. 2d ed., Pp. 578. *Reviewed in this issue.*

Head Injuries and Their Management. By Francis Asbury Echlin. Philadelphia: The J. B. Lippincott Company, 1956. Pp. 127, with 10 illustrations.

Pye's Surgical Handicraft. Edited by Hamilton Bailey. Bristol: John Wright & Sons, Ltd., 1956. 17th ed. Pp. 800, with 860 illustrations. *Reviewed in this issue.*

Les Ecrasements Thoraciques (Crushing Injuries of the Chest). By Jean Garby, Michel Garbay and Claude Vanderpooten. Paris: Masson et Cie, 1957. Pp. 132. *Reviewed in this issue.*

The Stress of Life. By Hans Selye. New York: McGraw-Hill Book Company, Inc., 1956. Book V. Pp. 324.

Ciba Foundation Symposium on Bone Structure and Metabolism. By G. E. W. Wolstenholme and Cecilia M. O'Connor. Boston: Little, Brown & Company, 1956. Pp. 299, with 121 illustrations. *Reviewed in this issue.*

Practical Office Gynecology (Obstetrics and Gynecology Series, edited by Caude E. Heaton). By Albert Decker and Wayne H. Decker. Philadelphia: F. A. Davis Co., 1956. Pp. 388, with 103 illustrations, 19 in color. *Reviewed in this issue.*

Clinical Urology. By Oswald Swinney Lowsley and Thomas J. Kirwin. Baltimore: The Williams and Wilkins Company, 1956. 2 volumes, profusely illustrated; drawings by William Didusch.

BOOKS REVIEWED

Pye's Surgical Handicraft. Edited by Hamilton Bailey. Bristol: John Wright & Sons, Ltd., 1956. 17th ed. Pp. 800, with 860 illustrations.

Students and readers of the surgical literature have long been accustomed to expect from the pen of Mr. Hamilton Bailey, whether he wields it as author or as editor, only the best. The seventeenth edition of *Pye's Surgical Handicraft* will not disappoint them. "When I assumed the editorship in 1938," he writes in his Introduction, "I went about my task in a way of which I believe Mr. Pye would have approved; I inquired from House Surgeons and Practitioners what they wanted to find in a book of this character. I have continued this policy, but so vast is the horizon of surgery today compared with that of sixty years ago that without the specialized help of the contributors it would have been impossible for me to have continued to provide what Mr. Pye provided—a practical handbook suited to the need of the reader."

Mr. Bailey has now edited eight editions of his surgical classics, and even with competent contributors it must have been a colossal task. Covering as it does the entire and enormous field of surgery, it must have posed a problem in organization alone.

As always, the work is lavishly illustrated, with a number of the remarkably true-to-life color plates for which Mr. Bailey is famous. The index is excellent.

It would be impossible in the space available to mention all of the thirty-nine chapters by title; moreover, since the volume is exactly what its original author called it, a manual of surgical "handicraft," there is no need to do so; first, because most readers are entirely familiar with former editions, and second, because the emphasis has been rightly placed on method and technic rather than theory. The new edition brings the material strictly up to date; the chapters on fluid and electrolyte balance, anesthesia and antibiotic therapy are excellent. One of the most praiseworthy features of the book is the inclusion of practical guidance not directly associated with surgical technic: surgeon-patient and surgeon-nurse relations, hospital administration, certification of death, etc.

Apparent on every page are the patience and exactitude of genuine scholarship. No words are wasted; every sentence is to the point, a fact that reflects great credit on the editor. Nor is any passage in the least unclear; an intelligent layman could read the book and enjoy it—and unquestionably learn a great deal from it, too.

When a book has been a classic in its field for many years, the responsibility of periodic revision, expansion and addition is no light one. At first glance it may seem unkind to wish Mr. Bailey long continuance in so onerous a charge, but that is the penalty of doing a task magnificently. The personal modesty and scientific detachment with which Mr. Bailey has set himself to preserving the original author's spirit and intention does him great honor.

M. T.

Bases Physiologiques de la Chirurgie Neuro-Vasculaire. By C. Mentha. Paris: Masson et Cie, 1956. Pp. 148, with 32 illustrations.

This is a scholarly and well-organized treatise that considers especially problems concerning the sympathetic innervation of the extremities and the head and neck. There is little emphasis on the innervation of the thoracic, abdominal and pelvic viscera. What is known about the cerebral control of visceral functions is thoroughly discussed, and considerable attention is paid to pharmacologic reactions.

The author is especially concerned with the problems of vasomotor control and has developed a concept of "mutual assistance of vascular territories" that he uses to explain some of the failures of sympathectomy and some of its complications. According to this concept, any hyperemia provoked in a vascular territory necessarily entails compensa-

tory ischemia in another vascular territory, provided the circulating blood volume remains constant. Thus vasodilation can be complete only if it is elective and restricted to a given vascular territory or distribution.

The anatomic pathways are thoroughly considered, especially the questions of accessory sympathetic fibers in the anterior roots of spinal nerves, afferent pupillodilators fibers and sudoriferous fibers. These and other fundamental problems of the sympathetic nervous system are dealt with in a way that makes this monograph essential to all students in the field.

The book is dedicated to Prof. Leriche and carries a preface written by this pioneer in the surgery of the sympathetic nervous system.

HAROLD C. VORIS, M.D.

Chirurgie du Pancréas. By Lucien Leger and Jacques Bréhant. Paris: Masson et Cie, 1956. Pp. 504. Illustrated (Collection of Henri Mondor).

This volume is the sixth in the collection of surgical monographs proposed by Dr. Henri Mondor and appropriately bearing his name. His also has been the duty of choosing the collaborators, whose distinction assures a warm reception for each of the twenty-odd volumes in the complete series. Of the coauthors of the present volume, Dr. Leger is professor agrégé at the University of Paris, and Dr. Bréhant at the University of Algiers.

Their product well illustrates the value of these monographs in bridging the disadvantages of précis and treatise, a problem on which Mondor has remarked. The review they present is systematic and comprehensive; at the same time, by schematizing and selecting, they have produced a convenient working tool for surgeon, surgical resident, and student alike. Aware of these varied but exacting needs, the authors have sifted the literature to include the most important recent experimental and clinical experience, adding recent material from their personal case records. The bibliographies are likewise highly selective, limited to the most basic or recent references. The only criticism one might offer in this regard is that many of the authors cited in the text are left without references in the notes or bibliography, a usage that may prove inconvenient to the advanced or research worker.

Minor shortcomings do not, however, detract from the value, timeliness and authority of the work, which assure that it will find prompt acceptance in centers of medical education throughout the French-speaking world.

The contents include sections on anomalies, traumas, acute pancreatitis, cysts, parasitic cysts, ascaridiasis, cystic fibrosis, fistulas, tuberculosis, syphilis, chronic pancreatitis, lithiasis, cancer and hypoglycemia. Some suggestions are given for the surgical treatment of insulin-resistant diabetes.

Those who know the splendid surgical work done by Prof. Leger and his outstanding teaching gifts will appreciate the value of this splendid contribution to contemporary surgical literature. It is to be hoped that the work will be translated into other languages.

M. T.

Diagnostic Procedures for Virus and Rickettsial Diseases. New York: American Public Health Association: Publication Office, 1956. 2d ed., Pp. 578.

This second edition, which appears eight years after the publication of the first edition, represents the combined efforts of numerous authors who are authorities on their respective subjects and leading investigators of diagnostic procedures.

Thomas Francis Jr., M.D. is the Chairman of the Committee on Diagnostic Procedures for Virus and Rickettsial Diseases, American Public Health Association, which is responsible for publication of this volume.

Four new chapters have been added to the second edition. The first chapter, written by Edwin H. Lennette, presents general principles of laboratory diagnosis; one chapter, written by Joseph L. Melnick, is devoted to methods of tissue culture for the cultivation of poliomyelitis and other virus diseases. Another chapter discusses the diagnosis of "miscellaneous virus diseases." This was prepared by Morris R.

Hilleman. A chapter was written also by Gilbert Dalldorf and Grace M. Sickles.

The remainder of the chapters were, in general, written by the same authors who discussed their respective fields in the first edition. A few new authors have been added.

The book, written by the outstanding men in the field of virus and rickettsial diseases, represents a summary of current knowledge in a rapidly expanding field. Although the diagnostic procedures discussed in the volume are not suitable for the average hospital laboratory, this book, which contains a wealth of information, belongs in the Library of every pathologist, bacteriologist and virologist.

WERNER F. EISENSTAEDT, M.D.

Les Ecrasements Thoraciques (Crushing Injuries of the Chest). By Jean Garbay, Michel Garbay and Claude Vanderpooten. Paris: Masson et Cie, 1957. Pp. 132.

The scarcity of books on injuries of the chest as compared with the great number available on the treatment of injuries of the brain and skull prompted the authors to write this excellent concise volume. Since approximately one-third of all fatalities resulting from automobile accidents and falls are due to crushing injuries of the thorax, this book is timely. It is based on current knowledge of physiologic and pathologic conceptions of diseases of the chest. The opinions expressed by the authors are the result of their successes and failures in thoracic surgery.

The physician who first examines the patient after injury can obtain invaluable advice as to proper treatment of these injuries, viz., relief of pressure on the heart due to air and/or blood, tracheal intubation, well-timed tracheotomy, thoracotomy, etc. The authors emphasize the importance of remaining with the patient constantly in order to observe each minute reaction, thereby obtaining the opportunity of instituting life-saving measures at once. The authors also deal with the more complicated problems of rupture of the bronchus and lung, chylothorax, fracture of the rib cage, etc., and their definitive surgical treatment.

The book is divided into five chapters: (1) general considerations; (2) physiopathology (including cardiorespiratory complications and thoracic shock, with their clinical aspects); (3) therapeutic measures to combat the mechanical factors causing cardiovascular imbalance: oxygen therapy, treatment of shock, medical and surgical supervision, etc.; (4) analytic study and treatment of various lesions encountered: chest wall, hemothorax, chylothorax, rupture of the bronchi and cardiac trauma. (The ensuing pulmonary complications, wet lung, atelectasis, acute pulmonary edema, embolism and bronchopulmonary infections, are considered in detail), and (5) the extrathoracic complications mentioned, which include acute renal insufficiency, associated injuries to abdominal organs, liver, spleen, and kidneys, in addition to brain and skull.

The preface is written by the outstanding thoracic surgeon Professor René Sauvage, who lauds the work of the authors as excellent. The bibliography contains a list of 275 articles, many of them American references, all listed under subject headings, which makes it most convenient for reference.

This book acts as a link between the physician who first treats the patient and the highly specialized thoracic surgeon. Both will profit from reading it.

CHARLES PIERRE MATHÉ, M.D.

Ciba Foundation Symposium on Bone Structure and Metabolism. Edited by G. E. W. Wolstenholme, and Cecilia M. O'Connor. Boston: Little, Brown & Company, 1956. Pp. 299, with 121 illustrations.

This booklet represents the minutes of a symposium on bone structure and metabolism held on July 12-14, 1955. The subjects of discussion were structures of bone, fibrogenesis and metabolism.

Different subjects were discussed by experts in their respective fields. After each lecture a lively discussion followed.

The book represents a summary of current knowledge of a highly difficult and specialized subject. It can be recommended to anyone interested in this field.

WERNER F. EISENSTAEDT, M.D.

Practical Office Gynecology. (Obstetrics and Gynecology Series, edited by Claude E. Heaton.) By Albert Decker and Wayne H. Decker. Philadelphia: F. A. Davis Co., 1956. Pp. 388, with 103 illustrations, 19 in color.

Not a treatise on gynecology, this work is a concise and practical review and "refresher course" that will assist the nonspecialist to employ useful information in a practical way. The emphasis is on office procedures and management, but since the indications for surgical intervention are an essential concern of the examining physician, they receive a special chapter. The overall approach is the symptomatic one, which in the author's opinion will prove most useful to the general practitioner. With this need in mind, they have included concise presentations of particular gynecologic entities. Their comments are always to the point, being often direct statements of what the authors do or do not find useful, and almost entirely limited to clinical methods, with a minimum of theory and pathologic exposition. Their evaluation of therapy, drugs and methods, is thus placed at the reader's fingertips. Whatever its failings, this book is without doubt one of the easiest to use that this reviewer has yet examined.

Several points of emphasis deserve attention in review. One is the emphasis on diagnosis, which is to be expected, and especially on methods of evaluation as aids to diagnosis. Another is the constant and praiseworthy emphasis on biopsy in the examination of all benign growths. A third is emphasis on suspecting malignant change as an etiologic factor in various complaints. Methods of examination are given careful attention, including the taking of smears for cytologic study. The reader must not, however, expect complete details of these methods; the evaluation and application that the authors have gleaned from their own practice are the book's most prominent feature.

This is perhaps the chief value of the book, since it frankly offers a clear statement of those principles of management found successful by the authors in their own office. The senior author is well known through his introduction of the technic of culdoscopy, the direct instrumental visualization of the intrapelvic contents. A final chapter describes this technic, with illustrations. It is safe to say that many physicians will agree with the authors that the method is one for the specialist and, in any case, would not attempt the procedure outside a hospital.

Dr. Decker is also recognized for his work on infertility, and his step-by-step advice on examination of the sterile patient deserves the attention of both specialist and general practitioner. The authority of both authors and their clear presentation should win early acceptance for their latest offering.

R. L.

Etiologic Factors in Renal Lithiasis. By Arthur J. Butt. Springfield, Ill.: Charles C Thomas, Publisher, 1956. Pp. 401, with 153 illustrations.

This book offers an appraisal or evaluation of the etiologic factors in calculous disease. The text and material data of this book are summations by probably twenty experienced investigators. It is well presented and authoritative probably of more value to the basic scientist than to the clinician, but could be read with profit by everyone interested in calculous disease.

The chapters on the historical data and on the geographic, racial and climatic factors in relation to the causation of calculous disease are interesting and authoritative, particularly to the clinician, and point out numerous discrepancies that are presently acknowledged as truths.

The colloid theory of the causation of calculous disease and the effects of hyaluronidase on the urine, both experimental and clinical, are very clearly and exhaustively presented.

The bibliographic references are extensive and authentic, permitting intensive reference study of a given phase of the subject.

The book is well printed on good paper, and the illustrations are numerous, are of good quality and excellently reproduced.

The book is worthy of careful study and consideration by any student or investigator of urolithiasis, although it does not completely explain all the factors or phases of causation.

LOWRAIN E. MCCREA, M.D.

IMPORTANT ANNOUNCEMENT

Contributors of scientific articles for publication in The Journal of the International College of Surgeons from Europe, the Near East and the Middle East should send their articles to:

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